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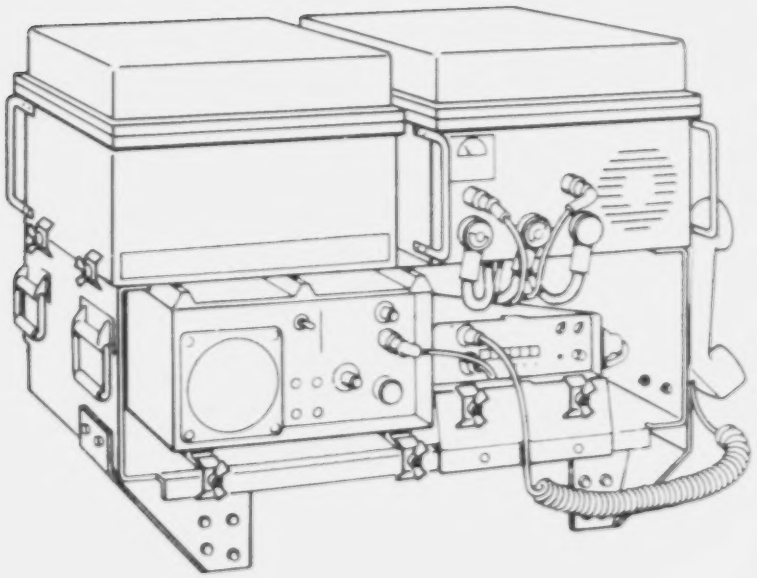
TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL



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DIRECT SUPPORT MAINTENANCE INSTRUCTIONS PAGE 5-1

RADIO SET AN/GRC-193A (NSN 5820-01-133-4195)

HEADQUARTERS, DEPARTMENT OF THE ARMY

14 FEBRUARY 1986

READEX FICHE best copy available

D 101.11:

WARNING

HIGH VOLTAGE

is used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections or 115 volt ac input connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through the body.

Warning: Do not be misled by the term "low voltage." Potentials as low as 50 volts may cause death under adverse conditions.

For Artificial Respiration, refer to FM 21-11.

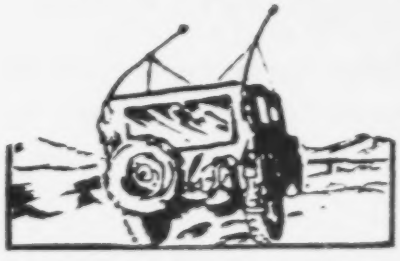
WARNING

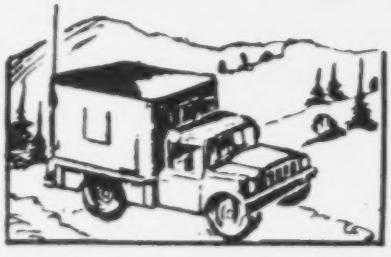
SERIOUS INJURY OR EVEN DEATH CAN HAPPEN IF THE FOLLOWING ARE NOT CAREFULLY OBSERVED WHEN INSTALLING AND USING THE ANTENNAS USED WITH YOUR RADIO SETS

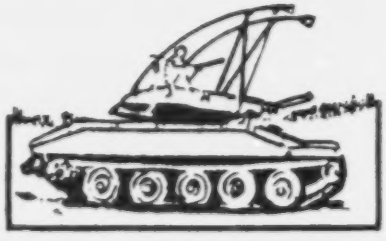
BEFORE ANY MISSION FIND OUT

1. ARE THERE ANY POWERLINES IN YOUR AREA OF OPERATION ?
2. HOW HIGH ARE THESE POWERLINES ?
3. HOW TALL ARE THE POLES OR TOWERS CARRYING POWERLINES ?

MOBILE OPERATION WITH WHIP ANTENNAS





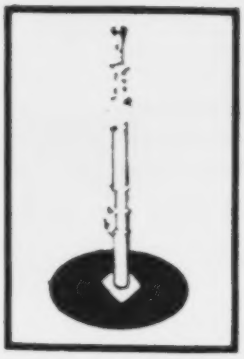


DO NOT STOP YOUR VEHICLE UNDER POWERLINES.

- IF POSSIBLE, TRY TO MAINTAIN MOBILE COMMUNICATIONS WITH YOUR ANTENNA(S) TIED DOWN.
- MAKE SURE AN ANTENNA TIP CAP IS SECURELY TAPED ON THE END OF EACH WHIP ANTENNA.
- DO NOT LEAN AGAINST OR TOUCH A WHIP ANTENNA WHILE THE TRANSMITTER IS ON.
- DURING CROSS-COUNTRY OPERATION, DO NOT ALLOW ANYONE TO STICK AN ARM, LEG OR WEAPON OVER THE SIDES OF THE VEHICLE. IF YOUR ANTENNA ACCIDENTALLY TOUCHES A POWERLINE AND A LEG, ARM OR WEAPON CONTACTS A DAMP BUSH OR THE GROUND, A SERIOUS OR FATAL ACCIDENT CAN HAPPEN.
- IF YOU ARE NOT SURE THAT AN ANTENNA ON YOUR VEHICLE WILL CLEAR A POWERLINE, STOP BEFORE YOU GET CLOSE TO THE POWERLINE AND EITHER CAREFULLY TIE DOWN THE ANTENNA OR REMOVE ANTENNA SECTIONS TO MAKE SURE THAT YOU CAN SAFELY DRIVE UNDER THE POWERLINE.

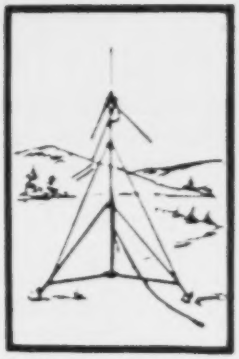
FIXED OPERATION WITH LONG RANGE ANTENNAS

WARNING



TELESCOPING ANTENNA MAST

TYPICAL TOWER



EXTENDED RANGE ANTENNA

DOUBLET ANTENNA

NEVER ERECT THESE LONG RANGE ANTENNAS DIRECTLY UNDER POWERLINES.

IF YOU MUST ERECT THESE LONG RANGE ANTENNAS NEAR POWERLINES, POWERLINE POLES OR TOWERS, OR BUILDINGS WITH OVERHEAD POWERLINE CONNECTIONS, NEVER PUT THE ANTENNA CLOSER THAN TWO TIMES THE ANTENNA HEIGHT FROM THE BASE OF THE POWERLINE, POLE, TOWER OR BUILDINGS.

NEVER ATTEMPT TO ERECT ANY LONG RANGE ANTENNA WITHOUT A FULL TEAM.

BEFORE ERECTING ANY LONG RANGE ANTENNA, INSPECT ALL THE PARTS MAKING UP THE ANTENNA KIT. DO NOT ERECT THE ANTENNA IF ANY PARTS ARE MISSING OR DAMAGED.

DO AS MUCH OF THE ASSEMBLY WORK AS POSSIBLE ON THE GROUND.

WHEN ERECTING THE ANTENNA, ALLOW ONLY TEAM PERSONNEL IN THE ERECTION AREA.

MAKE SURE THAT THE AREA FOR THE ANCHORS IS FIRM. IF THE GROUND IS MARSHY OR SANDY, GET SPECIFIC INSTRUCTIONS FROM YOUR CREW CHIEF OR SUPERVISOR ON HOW TO REINFORCE THE ANCHORS.

WHEN SELECTING LOCATIONS FOR ANCHORS, AVOID TRAVELED AREAS AND ROADS. IF YOU CANNOT AVOID THESE AREAS, GET SPECIFIC INSTRUCTIONS FROM YOUR SUPERVISOR AS TO WHAT CLEARANCE YOUR GUY WIRES AND ROPES MUST HAVE OVER THE TRAVELED AREAS AND ROAD.

CLEARLY MARK ALL GUY WIRES AND ROPES WITH THE WARNING FLAGS OR SIGNS SUPPLIED BY YOUR UNIT. IN AN EMERGENCY, USE STRIPS OF WHITE CLOTH AS WARNING STREAMERS.

IF YOU SUSPECT THAT POWERLINES HAVE MADE ACCIDENTAL CONTACT WITH YOUR ANTENNA, STOP OPERATING, ROPE OFF THE ANTENNA AREA, AND NOTIFY YOUR SUPERIORS.

IF THE WEATHER IN YOUR AREA CAN CAUSE ICE TO FORM ON YOUR LONG RANGE ANTENNA AND ITS GUY WIRES AND ROPES, ADD EXTRA GUYS TO SUPPORT THE SYSTEM. ROPE OFF THE AREA AND POST IT WITH WARNING SIGNS LIKE "BEWARE OF FALLING ICE."

DO NOT TRY TO ERECT ANY ANTENNA DURING AN ELECTRICAL STORM.

KEEP A SHARP EYE ON YOUR ANCHORS AND GUYS. CHECK THEM DAILY AND IMMEDIATELY BEFORE AND AFTER BAD WEATHER.

WARNING

HIGH VOLTAGE is used in the operation of this equipment. DEATH ON CONTACT or severe electrical shock may result if personnel fail to observe safety precautions. Learn the area of high voltage in each piece of equipment. Be careful not to contact high voltage connections when installing or operating this equipment.

WARNING

High voltages are present on the antenna during transmission. Do not touch or stand near the antenna when the equipment is energized.

WARNING

Make sure power is off before performing cleaning and inspection procedures.

WARNING

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1. DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL
2. IF POSSIBLE , TURN OFF THE ELECTRICAL POWER
3. IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A WOODEN POLE OR A ROPE OR SOME OTHER INSULATING MATERIAL
4. SEND FOR HELP AS SOON AS POSSIBLE
5. AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

TECHNICAL MANUAL

No. 11-5820-924-13

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 14 February 1986

OPERATOR'S, ORGANIZATIONAL AND DIRECT SUPPORT MAINTENANCE MANUAL RADIO SET AN/GRC-193A (NSN 5820-01-133-4195)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, NJ 07703-5007. A reply will be furnished to you.

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	III	Technical Principles of Operation	1-7
CHAPTER 2	OPERATING INSTRUCTIONS		
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HOW TO USE THIS MANUAL

This manual is designed to help you operate and maintain the AN/GRC- 193A Radio Set. There is an alphabetical index located in the final pages for use in finding more specific items of information.

Paragraphs in this manual are numbered by chapter and order of appearance within a chapter. A subject index appears at the beginning of each chapter listing sections that are included in that chapter. A more specfic subject index is located at the beginning of each section to help you find the exact paragraph you're looking for.

Warning pages are located in the front of this manual. You should learn all warnings before operating or performing maintenance procedures on the equipment.

Read all preliminary material found at the beginning of each task. It contains important information and safety instructions necessary to complete procedures.

Instructions for using troubleshooting tables are located in paragraphs 3-1 and 4-5.

Instructions for performing PMCS are located in paragraphs 2-2 and 4- 4.

There is a Maintenance Allocation Chart (MAC) located in appendix B which is current as of July 31, 1985.

Measurements in this manual are given in both US standard and metric units.

CHAPTER 1

INTRODUCTION

Subject	Section	Page
General Information	I	1-1
Equipment Description	II	1-4
Technical Principles of Operation	III	1-8

Section I GENERAL INFORMATION

Subject	Para	Page
Scope	1-1	1-1
Consolidated Index of Army Publications and Blank Forms	1-2	1-1
Maintenance Forms, Records, and Report	1-3	1-1
Reporting Equipment Improvement Recommendations (EIR)	1-4	1-2
Nomenclature Cross-Reference List	1-5	1-2
Destruction of Army Materiel to Prevent Enemy Use	1-6	1-2
Preparation for Storage or Shipment	1-7	1-2
List of Abbreviations	1-8	1-2
Definition of Unusual Terms	1-9	1-4

1-1. SCOPE

Type of Manual: Operator's, Organizational, and Direct Support Maintenance Manual.

Equipment Name and Model Number: Radio Set AN/GRC-193A

Purpose of Equipment: The Radio Set AN/GRC-193A is a ruggedized tactical HF (high frequency) SSB (single sideband) voice and data communications station for fixed or transportable station applications.

1-2. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS.

Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

1-3. MAINTENANCE FORMS, RECORDS, AND REPORTS.

REPORT OF MAINTENANCE AND UNSATISFACTORY EQUIPMENT

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750 as contained in Maintenance Management Update.

REPORT OF PACKAGING AND HANDLING DEFICIENCIES

Fill out and forward SF 364 (Report of Discrepancy (ROD) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73A/AFR 400-54/MCO 4430.3F.

DISCREPANCY IN SHIPMENT REPORT (DISREP) (SF 361)

Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610, 19D/DLAR 4500.15

1-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMANDATIONS (EIR).

If your Radio Set AN/GRC-193A needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, New Jersey 07703-5007. A reply will be sent to you.

1-5. NOMENCLATURE CROSS-REFERENCE LIST.

This list contains common names used in place of official nomenclature in this manual.

COMMON NAME	OFFICIAL NOMENCLATURE
GRC-193A	Radio Set AN/GRC-193A
GRA-39	Radio Set Control Group AN/GRA-39C
CW KEY	CW KEY KY-872
AS-2259	NVIS Antenna AS-2259/GR
Ant Site Remoting Kit	Tactical Antenna Remoting Kit
GRA-50 (Doublet)	Antenna Group AN/GRA-50
Transceiver	Receiver-Exciter RT-1209/URC
Amplifier-Converter	Amplifier-Converter AM-6879/URC
Power Amplifier (PA)	Power Amplifier AM-6545A/GRC-193
Antenna Coupler	Antenna Coupler CU-2064/GRC-193

1-6. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

1-7. PREPARATION FOR STORAGE OR SHIPMENT.

Equipment shall be prepared for storage or shipment by performing Preventive Maintenance Checks and Services (PMCS) as prescribed in the PMCS charts included in this manual. These procedures should also be done when removing equipment from storage to ensure operational readiness.

Packing of equipment for storage or shipment will normally be performed at a packaging facility or by a packing team. If emergency packaging must be done, see paragraph 2-3 of this manual and reverse the process.

1-8. LIST OF ABBREVIATIONS.

The following is a list of abbreviations used in this manual.

ABBREVIATIONS

AAL	Additional Authorization List
AC	Amplifier-Converter
AC or ac	Alternating Current
Amps	Amperes
ANT	Antenna
ANT CPLR CB	Antenna Coupler Circuit Breaker
AVG	Average
C	Celsius (Centigrade)
COEIL	Components of End Item List
CONT	Control
CU	Antenna Coupler
CW	Continuous Wave
D-RCV	Data Receive
D-TR	Data-Transmit/Receive
dB	Decibel
DC or dc	Direct Current
DISREP	Discrepancy in Shipment Report
EIR	Equipment Improvement Recommendations
EMI	Electromagnetic Interference
F	Fahrenheit
FSCM	Federal Supply Code for Manufacturers
FSK	Frequency-Shift Keying
FT	Foot or Feet
HF	High Frequency
Hz	Hertz
kg	Kilograms
kHz	Kilohertz
lb	Pounds
LSB	Lower Sideband
MAC	Maintenance Allocation Chart
MHz	Megahertz
mW	Milliwatts
msec.	millisecond
NVIS	Near Vertical Incidence Skywave
PA	Power Amplifier
PA CB	Power Amplifier Circuit Breaker
PEP	Peak-Envelope Power
PMCS	Preventive Maintenance Checks and Services
PTT	Push-To-Talk
RDY	Ready
rf	Radio Frequency
RFI	Radio Frequency Interference
ROD	Report of Discrepancy
RT	Receiver Transmitter
SINAD	The ratio of signal plus noise plus distortion over the noise plus distortion
SSB	Single Sideband
SPKR	Speaker
TMDE	Test, Measurement and Diagnostic Equipment

ABBREVIATIONS

TTY	Teletypewriter
TUN	Tune
U/M	Unit of Measure
UHF	Ultra High Frequency
USB	Upper Sideband
uV	Microvolts
VHF	Very High Frequency
V-RCV	Voice-Receive
V-TR	Voice Transmit/Receive
XMT	Transmit

1-9. DEFINITION OF UNUSUAL TERMS.

Nominal . . . . . The stated or specified value as opposed to the actual value

Section II EQUIPMENT DESCRIPTION

Subject	Para	Page
Equipment Characteristics, Capabilities, and Features	1-10	1-4
Equipment Data	1-11	1-5
Location and Description of Major Components	1-12	1-6
Safety, Care, and Handling	1-13	1-7

1-10. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

The Radio Set AN/GRC-193A has the following features:

- Mountable on wheeled vehicles (M151, M151A1, M151A2, M561, M882) and tracked vehicles (M113 and M577).
- Full field compatibility with existing HF tactical radios, including AN/GRC-106, AN/MRC-138, AN/PRC-104, AN/PRC-74, AN/PRC-87, AN/GRC-165, AN/URC-58, and AN/URC-94(V).
- Complete automatic tuning in less than 6 seconds after a one minute warmup, frequency and mode selection, and momentary key of radio set.
- Full rated 400 Watt PEP or average output at continuous TX duty cycle under any worst case combination of environment (e.g., temperature and primary power supply conditions).
- High efficiency - current drain less than 45 Amps at 26.5 Vdc, at 400 Watt average power output. Typical current drain is shown below.

MODE	POWER OUTPUT (Watts)	SUPPLY CURRENT (Amperes)
CW (key down)	400 W Average	42.5 A
Two-tone	400 W PEP	31.0 A
Voice	400 W PEP	17.0 A
Receive	----	5.5 A
Receive only	----	.5 A

- Rugged, submersible - all equipment specifically designed for MIL ground mobile applications, sealed units submersible in 3 feet of water.
- Deployment flexibility - building block design allows a wide variety of configurations to meet operational and tactical requirements (e.g., remoting the antenna and antenna coupler, and shelter installations).
- Compatibility with various ancillary equipment, e.g., AN/VIC-1 Intercom, AN/TGC- 14A and AN/UGC-74 Teletype, AN/GRA-39C Radio Control Group, and a variety of standard and field expedient antennas (AS-2259 NVIS, GRA-50, long wire, etc.) and voice security equipment.
- Modular construction, meter and fault isolation indicators for easy maintenance.
- Built-in protection against abnormal operating conditions (e.g., shorted antenna, reversed polarity power supply, overtemperature, overvoltage).
- Built-in teletype ± 425 Hz shift keyer-converter (P/O AM-6879 Amplifier- Converter).
- 400-Watt or 100-Watt power output selection (front panel control on AM- 6545A).

1-11. EQUIPMENT DATA.

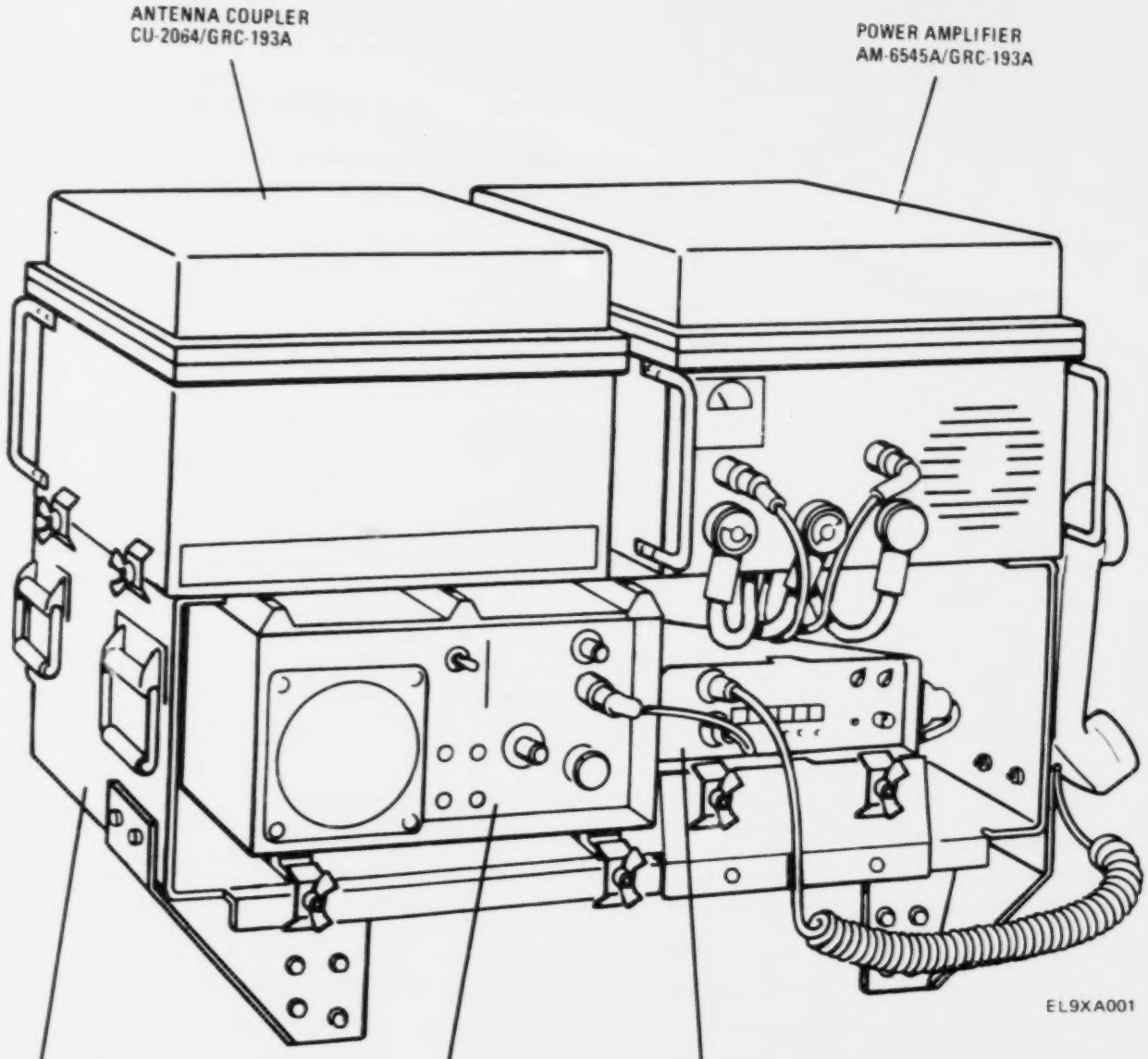
GENERAL

Frequency	2.0000 to 29.9999 MHz
Channels	280,000
Channel Spacing	100 Hz
Modes	USB, LSB, Voice, Data, CW and TTY, Receive-Transmit, Receive-Only
RF Output Power	400-Watts PEP or AVG ± 1 dB
Receiver Sensitivity	0.7 uV for 10 dB SINAD
Data Transmission Rate	75 baud (standard teletypewriter)
Tuning	Fully automatic in 6 seconds (after warmup)
Duty Cycle	Continuous transmit at 400-Watts AVG output power
Antenna Matching	Will match 15 to 35 ft whip, Doublet, AS-2259, or a field expedient long wire antenna.
Shock	20 g's for 11 milliseconds
Vibration	2.5 g's or 0.15, double amplitude
Primary Power	26.5 Vdc (nominal) standard 60 amp vehicle battery-alternator system
Temperature	-40°C (-40°F) to + 55°C (+ 131°F)
Altitude	0 to 10,000 feet, Operating

COMPONENT DIMENSIONS

Item	(Inches /Centimeters)			Weight (1b/kg)
	Height	Width	Length	
Receiver-Transmitter RT-1209/URC	2.6"(6.6)	7.25"(18.4)	7.25"(18.4)	5.8lb (2.6)
Amplifier-Converter AM-6879/URC	7.3"(18.5)	10.0"(25.4)	7.00"(17.84)	14.0lb (6.35)
Power Amplifier AM-6545/GRC-193	8.0"(20.3)	11.4"(28.9)	16.4"(41.7)	54.0lb (24.5)
Antenna Coupler CU-2064/GRC-193	8.0"(20.3)	14.4"(28.9)	14.8"(37.6)	40.0lb (18.1)

1-12. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.



1-13. SAFETY, CARE, AND HANDLING.

Obey all Warnings, Cautions, and Notes in this manual. Failure to follow directions could result in serious injury to personnel and/or damage to equipment.

Section III TECHNICAL PRINCIPLES OF OPERATION

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Power Amplifier AM-6545A/GRC-193	1-16	1-8
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Speaker On Mode	1-19	1-8
TTY On Mode	1-20	1-9
Interconnection Cables	1-21	1-9
Tools and Test Equipment	1-22	1-10

1-14. GENERAL

Radio Set AN/GRC-193A may be installed in a general purpose installation, such as a building tent, or it may be installed on an M151A1 1/4-Ton Utility Truck, an M561 1/4 Ton Cargo Truck, or on an M882 1 1/4-Ton Cargo Truck, an M113A1 Full Tracked Personnel Carrier, or on an M577A1 Light Tracked Command Post Carrier using a special mounting kit for each of the different applications. An Antenna Siting Kit allows the antenna and its coupler to be installed at a remote location, up to 200 feet from the rack-mounted equipment, in any of the configurations. Radio Set AN/GRC-193A is rack mounted in two different types of mounts for wheeled-vehicle installation and for tracked-vehicle installation.

Radio Set AN/GRC-193A is a ruggedized tactical HF (high frequency) SSB (single sideband) voice and data communications station for fixed or transportable station applications. It provides for voice, data, or teletype communications in simplex operation with any radio set operation at the same frequency in the HF band (2 to 29.9999 MHz) and using (USB) upper sideband or (LSB) lower sideband modulation. Voice or data messages are sent and received using simple operator controls on the receiver-transmitter to select the desired operation frequency, modulation, and operating mode. Controls on the amplifier-converter provides for teletype and local speaker operation.

System interconnection cabling is part of the electrical equipment racks in each of the installation kits. A handset, or source of teletype or data signals, and an antenna are required for system operation. The Radio-Set AN/GRC-193A can be powered by any source capable of supplying 20 to 32 Vdc at 50 amperes.

1-15. RECEIVER-TRANSMITTER RT-1209/URC.

Receiver-Transmitter RT-1209/URC, herein known as the RT or the receiver-transmitter, is a miniaturized HF-SSB transceiver that provides control of frequency, mode selection, SSB selection, transmit/receive switching, and tuning of the radio set. The receiver-transmitter can be operated in the USB or LSB, voice cw, or data modulation modes at any frequency from 2 to 29.9999 MHz, in increments of 100 Hz. Audio connections are provided for a handset, headset, CW key, or data inputs. The transmitter generates a SSB modulated carrier, either USB or LSB, of 250 mW + 3 dB radio frequency output signal. Receive rf signals are down-converted and demodulated in the receiver-transmitter to produce audio signals. Audio signals are routed to the headset earpiece and, if selected, to the speaker amplifier, or to the FSK

converter in the amplifier-converter. The receiver-transmitter provides frequency control and receive/transmit switching signals to the power amplifier and to the antenna coupler. The receiver-transmitter is supplied with + 26.5 Vdc (nominal) primary power via the power amplifier. The RT unit is ruggedized for vehicular use and attaches to the installation kit mounts with thumbscrew clamps.

1-16. POWER AMPLIFIER AM-6545A/GRC-193.

Power Amplifier AM-6545A, known as the power amplifier or the PA, is an automatically tuned, 400-watt, high frequency power amplifier designed for use with a single sideband receiver-transmitter. The PA is continuously tunable over the frequency range of 2 to 29.9999 MHz in response to bandswitching signals and the rf signal from the receiver-transmitter. The PA unit amplifies the rf input signal from the receiver-transmitter to 400-watts average or Peak Envelope Power (PEP) ± 1 dB output power signal. Primary power at + 26.5 Vdc, 60 amperes (nominal) is supplied to the PA from a vehicular electrical system or some other appropriate power source and is distributed from the PA to the receiver-transmitter (RT), amplifier converter (AC), and the antenna coupler (CU). Automatic tuning initiation and receive-transmit control signals are sent to the antenna coupler from the power amplifier. Fault indications are provided for self-testing. Panel meters are provided for monitoring output power and other internal PA operating parameters. The PA unit is cooled by a thermostatically controlled convection and forced air system. The electronic compartment is water-tight and the unit is submersible in fresh or salt water. The PA unit is provided with a one-way internal pressure release valve (4 psi). The PA unit is ruggedized for vehicular use and attaches to the installation kit mounts with thumbscrew clamps.

1-17. ANTENNA COUPLER CU-2064/GRC-193.

Antenna Coupler CU-2064, known as the antenna coupler or CU, automatically matches the impedance of the HF antenna to a 50-ohm coaxial transmission line to maintain a VSWR (Voltage Standing Wave Ratio) of 1.2:1 or less over the frequency range of 2 to 29.9999 MHz. Matching is accomplished automatically in response to a tune start signal from the receiver-transmitter via the power amplifier, and the application of the rf signal from the power amplifier. The antenna coupler provides a ready signal when tuning is complete. The 400 watt average or PEP ± 1 dB output of the power amplifier is coupled by the impedance matching network in the coupler to a compatible antenna terminal. Analog signals of forward and reflected power levels and tuning fault indications are sent to the power amplifier for display. The antenna coupler is cooled by a forced air heat exchange system consisting of a thermostatically controlled external fan and a continuously operating internal fan. The electronic compartment is water-tight and submersible in fresh or salt water. The CU unit is provided with a one-way internal pressure release valve (4 psi). The antenna coupler is ruggedized for vehicular use and attaches to the installation kit mounts with thumbscrew clamps.

1-18. AMPLIFIER-CONVERTER AM-6879/URC.

Amplifier-Converter AM-6879/URC, herein known as the AC or amplifier-converter, performs two separate functions in the AN/GRC-193A Radio Set. It contains a frequency-shift keying (FSK) converter that interfaces between a 75-baud teletypewriter and the audio circuits of the receiver-transmitter. It also contains an audio amplifier and speaker to provide a means of monitoring audio autput signals received by the receiver-transmitter. The speaker on (SPKR ON) or teletypewriter (TTY ON) functions are selectable by a front panel switch.

1-19. SPEAKER ON MODE.

In the speaker on mode (SPKR ON), received audio signals from the RT are amplified and applied to the front panel mounted speaker or to the headset earpiece, if the headset is connected to the front-panel mounted jack. A squelch circuit in the amplifier eliminates background noise from the speaker and

headset earpiece when no audio is being received. A control on the front panel is used to turn the squelch function on or off at higher squelch settings, weak audio signals as well as noise will be squelched. As the setting is lowered, weaker audio signals and the stronger noise will not be squelched. During transmission, the speaker is muted. Sidetone is heard only in the headset earpiece.

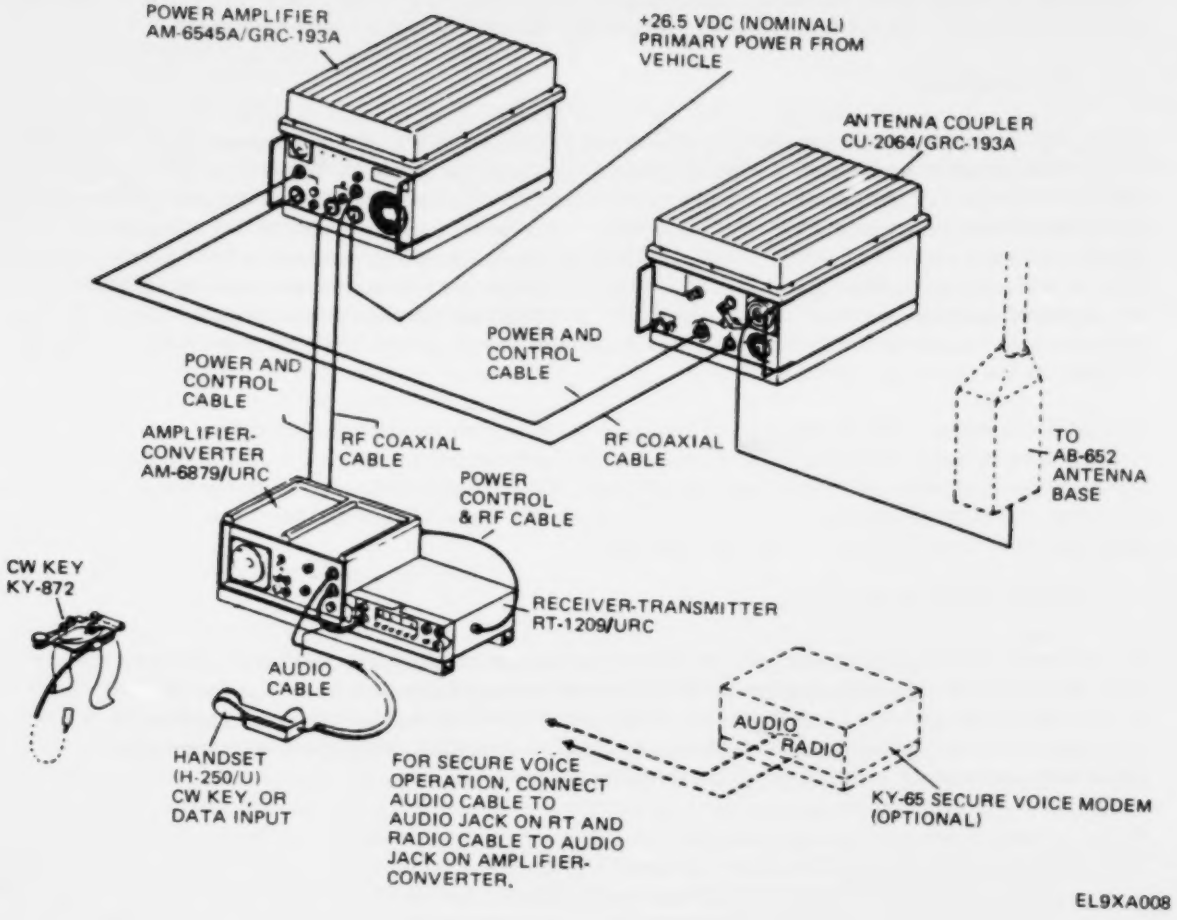
1-20. TTY ON MODE.

During TTY operation, a teletypewriter is connected to the DC LOOP or TTY KEY terminals on the front panel of the amplifier-converter. Terminals and controls are also provided for measurement and adjustment of the TTY loop current, using an external meter. During the TTY transmission, binary coded signals generated by operating the teletypewriter are converted into frequency shift keying audio signals. A frequency shift of + 425 Hz about a 2000 Hz center frequency produces a SPACE frequency of 2425 Hz and a MARK frequency of 1575 Hz. These FSK signals are sent to the receiver-transmitter where they are used to modulate the rf carrier signal. The rf output of the receiver-transmitter (that is the transmit signal) is routed trough an EMI (electromagnetic interference) filter in the amplifier-converter and then to the power amplifier.

During TTY reception, the received audio FSK modulated signals are demodulated then converted to binary coded signals to operate the teletypewriter connected to the front of the amplifier-converter. The teletypewriter then prints the received message. An RFI (radio frequency interference) filter in the amplifier-converter removes any RFI from the received TTY signal that might harm the radio set components or cause erroneous message translation.

1-21. INTERCONNECTION CABLES.

The cables for system interconnection are part of the equipment supplied. Cables for the connections from the amplifier-converter and the receiver-transmitter to the optional Secure Voice Modem KY-65 are part of the secure voice modem option. Radio Set AN/GRC-193A interconnection cabling is illustrated pictorially as follows and schematically in FO-1 and FO-2. Actual cable numbers are dependent upon which installation kit is used with the radio set.



1-22. TOOLS AND TEST EQUIPMENT.

In addition to the regular tool kits authorized at the different levels of maintenance, Electronic Equipment Tool Kit TK-100/G is required for installation. Standard test equipment is required for maintenance, such as a 20,000 ohms per volt multimeter for measuring and adjusting the TTY loop current, and is available at the organizational maintenance level.

CHAPTER 2

OPERATING INSTRUCTIONS

Subject	Section	Page
Description and Use of Operator's Controls and Indicators	I	2-1
Operators Preventive Maintenance Checks and Services (PMCS)	II	2-8
Operation Under Usual Conditions	III	2-13
Operation Under Unusual Conditions	IV	2-22

SECTION I DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

Subject	Para	Page
Operating Controls and Indicators	2-1	2-1
Receiver-Transmitter RT-1209/URC	2-1.1	2-1
Amplifier-Converter AM-6879/URC	2-1.2	2-2
Power Amplifier AM-6545A/GRC-193A	2-1.3	2-4
Antenna Coupler CU-2064/GRC-193A	2-1.4	2-7

2-1. OPERATING CONTROLS AND INDICATORS.

Operating controls and indicators on the receiver-transmitter, amplifier-converter, power amplifier, and antenna coupler are listed and their functions described in the following tabular sections. All operating controls and indicators are located on the front panels of these units and are shown pictorially near the description of each unit.

2-1.1. Receiver-Transmitter RT-1209/URC.

Operating controls and indicators on the receiver-transmitter are used to turn the radio set power on/off, control the speaker volume, select and display the frequency, mode, and sideband of the radio set, and light the frequency display, when desired.

RECEIVER-TRANSMITTER RT-1209/URC

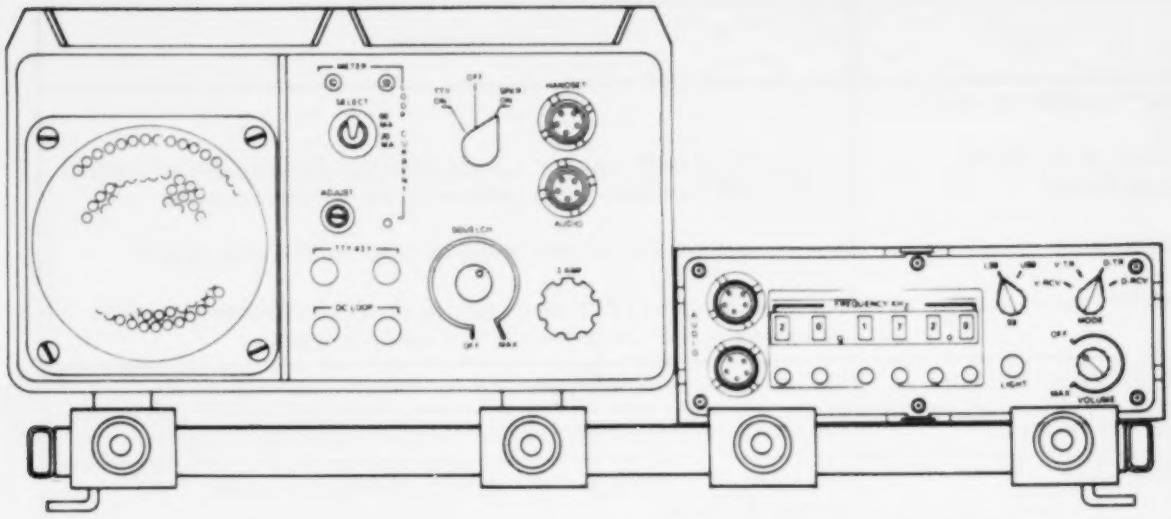
ITEM	FUNCTION
FREQUENCY KHz Pushbutton and display	Selects and displays frequency. System automatically tunes (when PTT switch on handset is operated) to selected frequency for all changes except 100 Hz (farthest right pushbutton). Each pushbutton changes the digit displayed above it by adding 1 to the displayed number. 280,000 frequencies are available between 2,000.0 and 29,999.9 kHz.

RECEIVER-TRANSMITTER RT-1209/URC (CONTINUTED)

ITEM	FUNCTION
SB (Sideband) Switch	Selects upper sideband (USB) or lower sideband (LSB) modulation of the selected carrier frequency. Either position can be used for voice and data signals; modulation must be the same as that used by a communicating radio.
MODE Switch	Selects one of four operating modes: V-RCV (Voice-Receive) - for receiving voice, CW, or teleprinter signals. V-TR (Voice-Transmit/Receive) - for transmitting and receiving voice, CW, or teleprinter signals. D-TR (Data-Transmit/Receive) - for transmitting and receiving data signals. D-RCV (Data-Receive) - for receiving data signals only.
VOLUME OFF/MAX Switch/Control	OFF position removes power from system. Clockwise rotation switches on system power and increases volume in handset earpiece and/or in the amplifier-converter speaker when the speaker is enabled.
LIGHT Switch	Lights FREQUENCY-KHz display when pressed.
AUDIO Connector (upper)	For connection of a handset for voice operation, or a CW key, or a data input.
AUDIO Connector (lower)	For connecting an audio cable to the amplifier-converter.
PTT (Push-To-Talk) Switch on handset (Attached to RT)	Initiates automatic fine tuning to selected frequency and keys transmitter in voice operation.

2-1.2. Amplifier-Converter AM-6879/URC.

Operating controls and indicators on the amplifier-converter are used to turn on/off the **TTY** or **SPKR** (Speaker) functions, turn on/off and control the amount of **SQUELCH**, select 20 or 60 mA **LOOP CURRENT**, and adjust the **LOOP CURRENT**.



AMPLIFIER-CONVERTER

RECEIVER-TRANSMITTER

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AMPLIFIER-CONVERTER & RECEIVER-TRANSMITTER
CONTROLS & INDICATORS

AMPLIFIER-CONVERTER AM-6879/URC

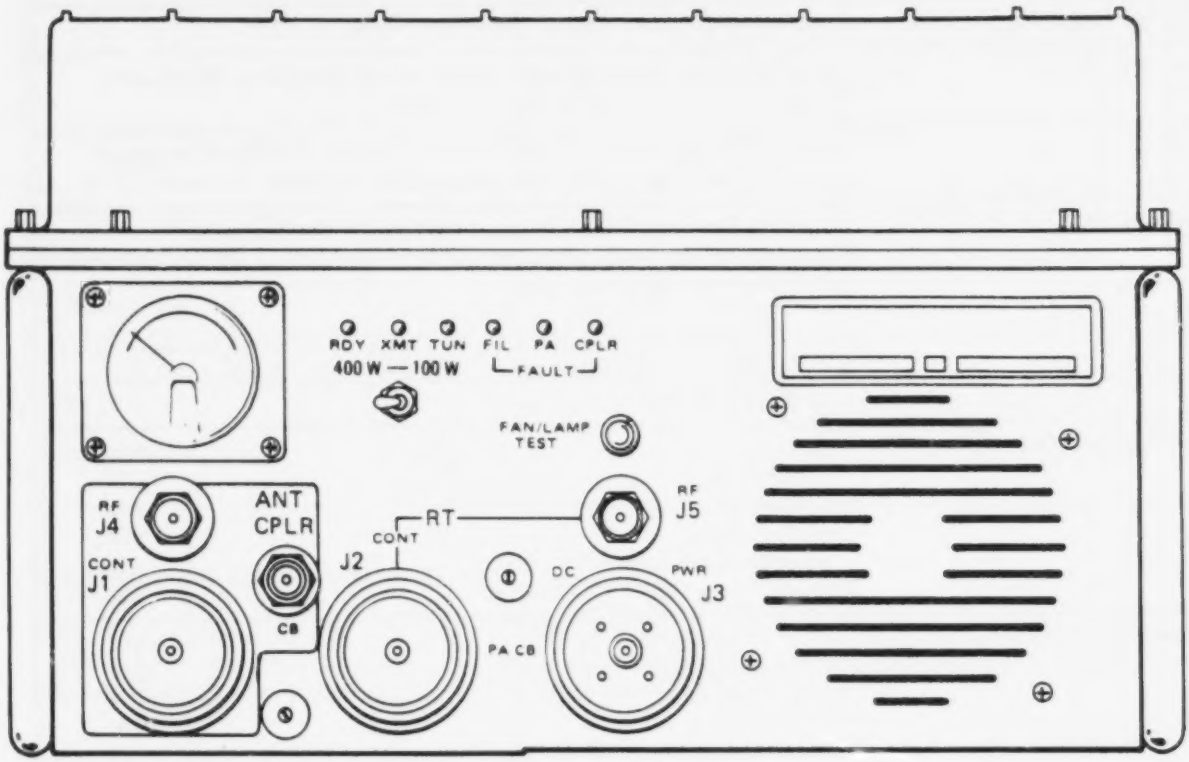
ITEM	FUNCTION
TTY ON/OFF/SPKR ON Selector Switch	Selects voice **(SPKR ON)** or data **(TTY ON)** functions of the amplifier-converter. If **SPKR ON** is selected, the received voice signals are amplified and applied to the speaker. If **TTY ON** is selected, a teletypewriter, connected at the **DC LOOP** terminals (for transmit/receive operation) or at the **TTY KEY** terminals (for transmit only), will be interfaced with the receiver-transmitter for radio teletype operation through an internal TTY converter.
SQUELCH OFF/MAX Switch/Control	Controls suppression of received audio when no useful voice signal is present. **OFF** position disables circuit; rotating control clockwise increases the level at which signals and noise are squelched. Desired setting reduces or eliminates background noise between useful audio signal receptions, but does not make useful signals inaudible.

AMPLIFIER-CONVERTER AM-6879/URC (CONTINUED)

ITEM	FUNCTION
LOOP CURRENT Controls	
SELECT 60 MA/20 MA Toggle Switch	Selects 60 mA or 20 mA loop current drive for teletypewriter connected to **DC LOOP** terminals. Set as required by the device connected.
METER Jacks	For connection to an external meter to read the **TTY** loop current
ADJUST Potentiometer	For fine tuning the **TTY** loop current to 20 or 60 milliamperes, as read on an external meter connected to the **METER** jacks.
TTY KEY Terminals	For connection of a teletypewriter for transmits only operation.
DC LOOP Terminals	For connection of a teletypewriter for transmit/receive operation.
3 AMP Fuse	Fuses circuits in the amplifier-converter. Fuse can be replaced by removing the cap.
LOUDSPEAKER	For output of received audio signals.
HANDSET Jack (Top)	For connection of a handset for voice operation, or a telegraph key for CW operation.
AUDIO Jack (Bottom)	For connection of an audio cable from the receiver-transmitter (except during secure voice operation).
REAR OF AMPLIFIER-CONVERTER	
J5 Jack	For connection of control and power cable to the power amplifier.
J6 Jack	For connection of control and power cable to the receiver-transmitter.
J7 Jack	For connection of rf signal cable to PA.

2-1.3. Power Amplifier AM-6545A/GRC-193A.

Operating controls and indicators on the power amplifier are used to test all the indicators/fan, turn on/off the antenna coupler and power amplifier power, display the PA output power or internal test voltages, indicate when a **FAULT** occurs for the **PA**, **CPLR**, or the **PA** tube **FIL** (filaments), and indicate when the PA is tuning **(TUN)**, ready **(RDY)**, and/or transmitting **(XMT)**.



POWER AMPLIFIER

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POWER AMPLIFIER AM-6545A/GRC-193A

ITEM	FUNCTION
FAN/LAMP TEST Pushbutton Switch	Press to test PA indicator lamps on front panel and test fans in the PA and the ANT CPLR.
400W-100W Toggle Switch	Selects either a 400-watt or 100-watt rf power output.
ANT CPLR CB	Circuit breaker for + 26.5-Vdc (nominal) power distributed to the antenna coupler. Press to reset, if tripped.
PA CB	Circuit breaker for + 26.5 Vdc (nominal) power distributed in power amplifier and fans in antenna coupler. Press to reset, if tripped.
Meter M1	Displays Forward rf Power during XMT mode. Can be manually switched inside the PA and used as a troubleshooting aid by displaying the following signal voltages: + 26.5 Vdc, V1 FILAMENT, V2 FILAMENT, + 19 Vdc, -14 Vdc, + 1600 Vdc, CATHODE LEVEL, Ip SENSE, ALC, FWD RF PWR, and RFLT RF PWR.
RDY Lamp **(GREEN)**	Function — Condition PA warming up. — OFF PA warmed up, in TUNE mode. — ON System tuning. — ON System tuned (ready to TX/RX). — ON During transmission (PTT pressed). — ON
XMT Lamp **(GREEN)**	Function — Condition PA warming up. — OFF[1] PA warmed up, in TUNE mode. — OFF System tuning. — ON System tuned (ready to TX/RX). — OFF During transmission (PTT pressed). — ON
TUN Lamp **(YELLOW)**	Function — Condition PA warming up. — ON PA warmed up, in TUNE mode. — ON System tuning. — ON System tuned (ready to TX/RX). — OFF During Transmission (PTT pressed). — OFF

OFF[1] - Inhibited during warmup, radio cannot be keyed.

POWER AMPLIFIER AM-6545A/GRC-193A (CONTINUTED)

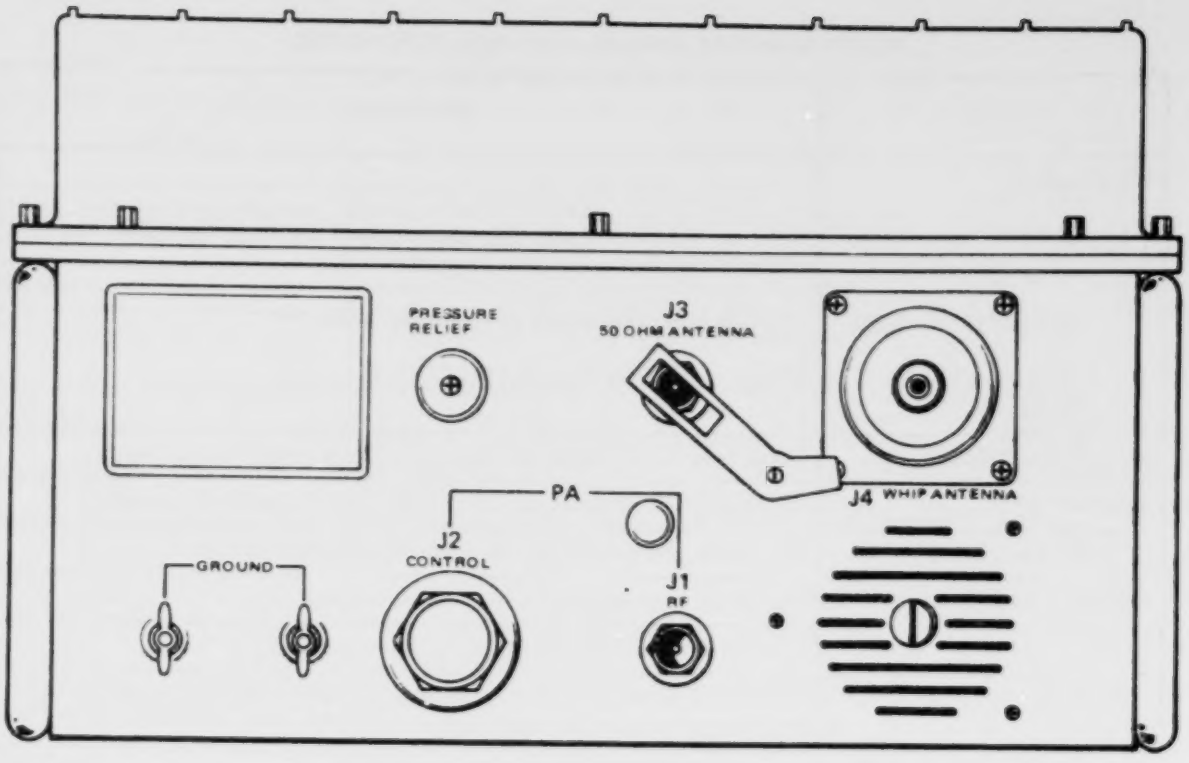
ITEM	FUNCTION
FAULT Lamps	
FIL FAULT Lamp (YEL)	When lit, indicates faulty filament in one of the amplifier tubes. Radio will still work but with reduced performance.
PA FAULT Lamp (RED)	When lit, indicates a fault in the power amplifier.
CPLR FAULT Lamp (RED)	When lit, indicates a fault in the antenna coupler.
ANT CPLR CONT J1 Jack	For connection of power and control cable to antenna coupler.
RT CONT J2 Jack	For connection of power and control cable to amplifier-converter.
DC PWR J3 Jack	For connection of primary power cable to power source.
ANT CPLR RF J4 Jack	For connection of RF cable to antenna coupler.
RT RF J5 Jack	For connection of RF cable to amplifier-converter.
Pressure Relief Valve	Releases internal pressure in power amplifier, if it exceeds 4 PSIA (pounds per square inch, ambient).

2-1.4. Antenna Coupler CU-2064/GRC-193A

The Antenna Coupler has one control and no indicators for operational use. The flag switch on the front panel is operated when an antenna cable connection is made to the unit. The flag switch is a mechanical interlock that prevents the connection of more than one antenna at a time.

ANTENNA COUPLER CU-2064/GRC-193A

ITEM	FUNCTION
Antenna Flag Switch	Mechanically prevents the connection of more than one antenna at a time.
PA RF J1 Jack	For connection of RF cable to power amplifier.
PA CONTROL J2 Jack	For connection of power and control cable to power amplifier.
50 OHM ANTENNA J3 Jack	For connection of 50-ohm antenna cable.
WHIP ANTENNA J4 Jack	For connection whip antenna cable.
Pressure Relief Valve	Releases internal pressure in antenna coupler, if it exceeds 4 PSIA (pounds per square inch, ambient).
Chassis Ground Terminals	For connection of ground straps.



ANTENNA COUPLER

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ANTENNA COUPLER INDICATORS AND CONTROLS

SECTION II OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Subject	Para	Page
General	2-2	2-8
Operator Preventive Maintenance Checks and Services (PMCS)		2-9

2-2. GENERAL.

To ensure operational readiness of Radio Set AN/GRC-193A, it must be inspected at definite intervals so that defects may be found and corrected before they result in serious damage or failure. The Preventive Maintenance Checks and Services (PMCS) which must be done are listed on page 2-9.

The Preventive Maintenance Checks and Services procedures are required to keep your equipment in good operating condition. They include (B) before operation, (D) during operation, and (A) after operation checks.

Perform the before and after checks if you are the assigned operator and have not operated the equipment since the last check or if you are operating the equipment for the first time.

If the equipment fails to operate, see operator troubleshooting procedures in chapter 3, section II of this manual. Use DA Pam 738-750 as a guide for reporting problems and using forms.

Routine checks like equipment inventory, cleaning components, checking for frayed and damaged cables, replacing items not in use, checking for loose hardware and safety wires, and corrosion on receptacles and connectors are not listed in the PMCS tables. You should do these things any time you see they need to be done as a matter of good preventive maintenance. If you find a routine check in the PMCS, it was listed because other operators reported problems with this item.

The ITEM NO. column in the PMCS table is to be used as source number for the TM number column on DA Form 2404. Equipment Inspection and Maintenance Worksheet, for recording PMCS results.

The EQUIPMENT IS NOT READY/AVAILABLE IF: column tells you why your equipment cannot be used if the ITEM TO BE INSPECTED does not meet PROCEDURE needs.

NOTE

Always keep in mind the warnings and cautions when doing PMCS or any routine checks.

OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

ITEM NO.	INTERVAL			ITEM TO BE INSPECTED	PROCEDURE	FOR READINESS REPORTING EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A			
				WARNING **DO NOT CLEAN THE EQUIPMENT IF THE POWER IS ON. THE FUMES OF TRICHLOROTRIFLUOROETHANE ARE TOXIC. PROVIDE THOROUGH VENTILATION WHENEVER IT IS USED. AVOID PROLONGED OR REPEATED BREATHING OF VAPOR. DO NOT USE NEAR AN OPEN FLAME OR HOT SURFACE. TRICHLOROTRIFLUOROETHANE IS NONFLAMMABLE, BUT HEAT CONVERTS THE FUMES TO A HIGHLY TOXIC PHOSGENE GAS, THE INHALATION OF WHICH COULD RESULT IN SERIOUS INJURY OR DEATH. PROLONGED OR REPEATED SKIN CONTACT WITH TRICHLOROTRIFLUOROETHANE CAN CAUSE SKIN INFLAMMATION. WHEN NECESSARY, USE GLOVES, SLEEVES, AND APRONS WHICH THE SOLVENT CANNOT PENETRATE.**		
1	•			Exterior surfaces	Clean the exterior surfaces of the components comprising the AN/GRC-193A.	

OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES (CONTINUED)

ITEM NO.	INTERVAL			ITEM TO BE INSPECTED	PROCEDURE	FOR READINESS REPORTING EQUIPMENT IS NOT READY/AVAIL-ABLE IF:
	B	D	A			
2	•			Intercabling and connectors	Check all interconnecting cables and connectors for cracks and breaks. Check to see that the bonding jumper grounds the equipment. Replace cables that have cuts, cracks, or broken connectors.	Cables have been cut, have cracks and breaks, or the bonding jumper is missing.
3	•			Meter face (glass)	Check to see that the meter faces (glass) are not loose or broken.	Glass on either the AM-6545A/GRC-193A or the RT-1209/URC is loose or broken.
4	•			Fuses	Check fuses on AM-6879/URC for correct value or quantity.	Fuses are not the correct value.
	•			CU-2064 and AM-6545A fan intake and output louvers	Check to see that there are no items in front or in back of the CU-2064 or the AM-6545A that will obstruct air flow through the components.	Air is not moving through the intakes or outputs.
6	•			Rubber seals on AM-6545A circuit breakers	Check to ensure that the seals on AM-6545A circuit breakers are not damaged or missing.	Rubber seals are broken or missing.
7		•		Knobs, controls, ands switches	While making the operational checks, observe that the mechanical action of each knob, switch, and control is smooth and free of external or internal binding. (See para 2-8.10)	

OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES (CONTINUED)

ITEM NO.	INTERVAL			ITEM TO BE INSPECTED	PROCEDURE	FOR READINESS REPORTING EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A			
				WARNING **THE FOLLOWING PROCEDURE REQUIRES THE BREAKING OF RADIO SILENCE. UNAUTHORIZED VIOLATION OF RADIO SILENCE COULD RESULT IN COURT MARTIAL OR POSSIBLE DEATH FROM HOSTILE ACTION.**		
8		•		Operational checks	Operate the equipment on an authorized frequency to verify its capabilities. (See para. 2-8.10)	Signals transmitted are not received, are not clear, or the AN/GRC-193A will not transit or receive.
9	•			Antenna Tip Cap	Check to see that the tip cap is secured to the tip of the top element. If cap is not available, make covering for tip of antenna using electrical or masking tape.	Antenna tip is not covered. NOTE: The equipment is not inoperative, but it is recommended that this item be fixed.
10	•			Antenna Tiedown (Whip)	The antenna should be pulled down to an angle that will not endanger personnel or interfere with power lines.	Antenna angle can cause injury to personnel or contact powerlines. NOTE: The equipment is not unoperable, but it is recommended that this item be fixed.
11	•			Voice or CW Operation	Check to see that all interconnect cables are connected per FO-1.	System interconnect cables not connected as shown in FO-1.
12	•			Secure Voice Operation	Check to see that all interconnect cables are connected per FO-2.	System interconnect cables not connected as shown in FO-2.

OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES (CONTINUED)

ITEM NO.	INTERVAL			ITEM TO BE INSPECTED	PROCEDURE	FOR READINESS REPORTING EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A			
13	•			TTY Operation (XMT Only)	Check to see that the teletypewriter is connected to the amplifier-converter terminals marked TTY KEY.	Teletypewriter not connected to amplifier-converter TTY KEY terminals correctly.
14	•			TTY Operation (CMT/REC)	Check to see that the teletypewriter is connected to the amplifier-converter terminals marked TTY KEY or DC LOOP.	Teletypewriter not connected to amplifier-converter terminals marked TTY KEY or DC LOOP.
				NOTE If required, the following step will be accomplished by higher category of maintenance.		
15	•			DC Loop Current	Determine the correct loop drive current. Connect an AN/PSM-45 Digital Multimeter to the METER terminals on the amplifier-converter. Loop both DC LOOP and TTY KEY terminals with jumper wires. Set meter to read DC current on 100 mA range. Turn the VOLUME/OFF/MAC control on the receiver-transmitter clockwise until the power is ON. Wait one (1) minute for the RT to warmup. Using a screwdriver, adjust the DC LOOP ADJ screw until the AN/PSM-45 meter reads 0.20 for 20 mA operation or 0.60 for 60 mA operation.	DC loop current is incorrect (Either 20 mA or 60 mA).

NOTE: If your equipment fails to operate, troubleshoot equipment using operator troubleshooting chart (Chapter 3, Section I). Report any deficiencies using DA Form 2404.

SECTION III OPERATION UNDER USUAL CONDITIONS

Subject	Para	Page
Unpacking	2-3	2-13
Assembly and Installation Instructions	2-4	2-14
Voice or CW Key Connections	2-4.1	2-15
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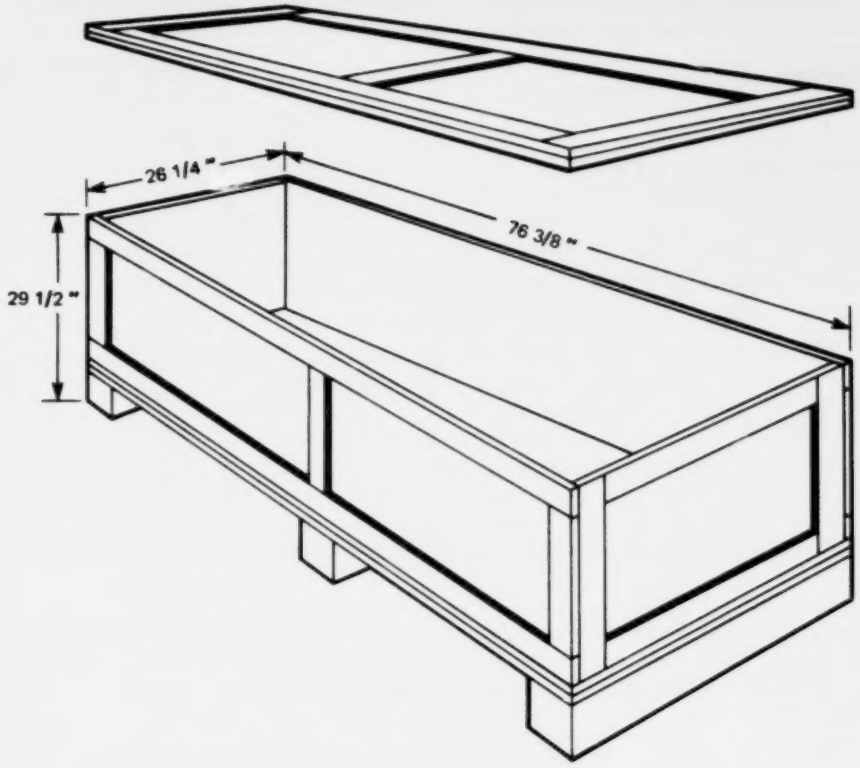
Operating Techniques	2-9	2-21

2-3. UNPACKING.

1. Open top of shipping crate containing Radio Set AN/GRC-193A.
2. Remove any loose packing material from crate.
3. Remove box containing AN/GRA-50 Antenna Group.
4. Open box and remove AN/GRA-50 Antenna Group.
5. Remove box containing AS-2259/GR Antenna.
6. Open box and remove AS-2259/GR Antenna.
7. Remove box containing H-250 Handset.
8. Open box and remove H-250 Handset.
9. Remove box containing RT-1209/URC Receiver-Transmitter unit.
10. Open box and remove RT-1209/URC Receiver-Transmitter unit.
11. Remove box containing KY-562/U Modified Telegraph Key.
12. Open box and remove KY-562/U Modified Telegraph Key.
13. Remove box containing AM-6879/URC Amplifier-Converter unit.
14. Open box and remove AM-6879/URC Amplifier-Converter unit.
15. Remove box containing CU-2064/GRC-193A Antenna Coupler unit.
16. Open box and remove CU-2064/GRC-193A Antenna Coupler unit.
17. Remove box containing AN/GRA-39C Radio Set Control Group.
18. Open box and remove AN/GRA-39C Radio Set Control Group.
19. Remove box containing AM-6545A/GRC-193A Power Amplifier unit.
20. Open box and remove AM-6545/GRC-193A Power Amplifier unit.
21. Remove Cable Reel from packing crate.
22. Remove Remote Siting Mounting Base from packing crate.

23. Remove Ground Rod from packing crate.



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24. Remove packing cardboard from crate.
25. Pull out ancililary kit and installation hardware bag.
26. Store all boxes and shipping material for future use.

After the AN/GRC-193A is unpacked, the following checks should be made.

1. Inspect equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on SF 364 (Report of Discrepancy (ROD)).

2. Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750 and paragraph 1-3, Maintenance Forms, Records, and Reports.

3. Check that all applicable Modification Work Orders (MWO's) have been applied to the equipment. Current MWO's for the equipment will be listed in DA Pam 310-1.

2-4. ASSEMBLY AND INSTALLATION INSTRUCTIONS.

The AN/GRC-193A Radio Set is used in many different applications. Some of these different applications require different installation kits. The following list of installation kit manuals are for some of the most common types of AN/GRC-193A installations. Most of the tools necessary for these installations can be found in Tool Kit, Electronic Equipment TK-101/G. Any additional tools are called out in the individual installation kit manuals, as necessary. Follow the installation instructions in the appropriate installation kit manual for the selected AN/GRC-193A Radio Set application.

TM 11-2300-474-13 & P-1 OPERATOR'S ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL, INCLUDING REPAIR PARTS AND SPECIAL TOOL LIST FOR INSTALLATION KIT MK-2460/GRC-193A IN CARRIER PERSONNEL, FULL TRACKED, M113A1, AND IN CARRIER COMMAND POST, LIGHT TRACKED, M577A1 FOR RADIO SET AN/GRC-193A

TM 11-2300-475-13 & P-1 OPERATOR'S, ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL, INCLUDING REPAIR PARTS AND SPECIAL TOOL LIST FOR INSTALLATION KIT MK-2462/GRC-193A IN TRUCK CARGO, 1 1/4 TON, 4X4, M882 AND M1008A1 CUCV FOR RADIO SET AN/GRC-193A

TM 11-2300-475-13 & P-2 OPERATOR'S, ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL, INCLUDING REPAIR PARTS AND SPECIAL TOOL LIST FOR INSTALLATION KIT MK-2459/GRC-193A IN GENERAL PURPOSE INSTALLATIONS FOR RADIO SET AN/GRC-193A

TM 11-2300-475-13 & P-3 OPERATOR'S, ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL, INCLUDING REPAIR PARTS AND SPECIAL TOOL LIST FOR INSTALLATION KIT MK-2461/GRC-193A IN TRUCK UTILITY, 1/4 TON, 4X4, M151, M151A1, OR M151A2 FOR RADIO SET AN/GRC-193A

TM 11-2300-475-13 & P-4 OPERATOR'S, ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL, INCLUDING REPAIR PARTS AND SPECIAL TOOL LIST FOR INSTALLATION KIT MK-2458/GRC-193A IN TRUCK CARGO, 1 1/4 TON, 6X6, M561 FOR RADIO SET AN/GRC-193A

2-4.1. Voice or CW Key Connections.

If voice or CW key operation is to be used, make the connections shown in figure FO-1. For voice operation, connect the handset to the **HANDSET** jack on the amplifier-converter or to the upper **AUDIO** jack on the receiver-transmitter. (Press connector inward and twist clockwise). The short audio cable is connected between the **AUDIO** jack on the amplifier-converter and the lower **AUDIO** jack on the receiver-transmitter. For CW key operation, connect the CW key to the **AUDIO** jack on the amplifier-converter. Connect the headset to the **AUDIO** jack on the receiver-transmitter.

2-4.2. Data Operation Connection.

For operations involving data transmission, use connections shown in figure FO-1. Connect the data input to either the **AUDIO** jack on the amplifier-converter or to the upper **AUDIO** jack on the receiver-transmitter.

2-4.3. Secure Voice Operation Connection.

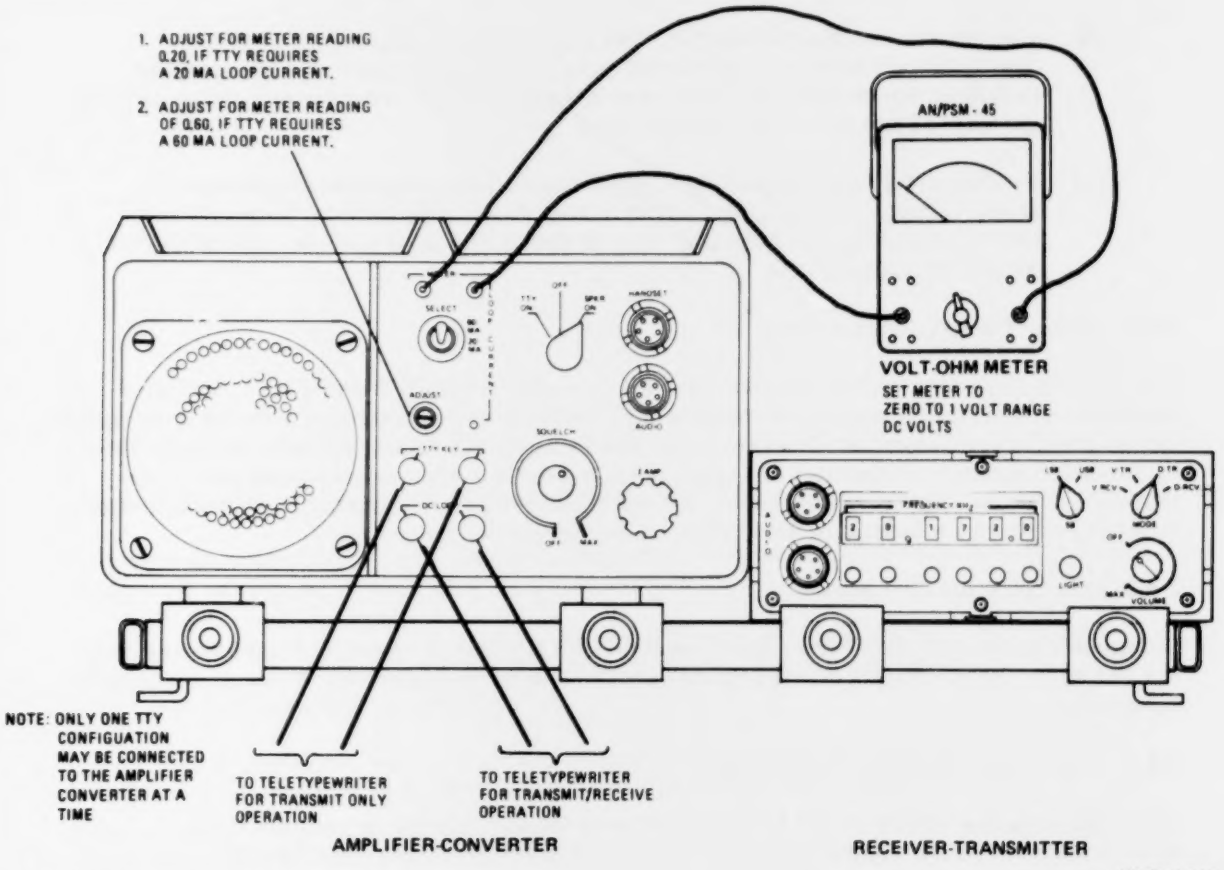
For secure voice operation with the KY-65 Secure Voice Modem, use the connections shown in figure FO-2. Disconnect the short audio cable from the lower **AUDIO** jack on the amplifier-converter (push connector inward and turn counterclockwise). Connect the KY-65 secure voice audio cable DN501553 between the **HANDSET** jack on the secure voice modem and the **AUDIO** jack on the receiver-transmitter. Connect the handset to the **HANDSET** connector on the amplifier-converter. Connect the KY-65 secure voice audio cable ONS13000 between the lower **AUDIO** connector on the amplifier-converter and the **HANDSET** connector on the secure voice modem.

2-4.4. Teletypewriter Operation Connection.

NOTE

Loop ADJ to be performed by ORGANIZATIONAL level maintenance and above.

The teletypewriter is connected to the terminals on the amplifier-converter. If transmit only operation is to be used, connect the teletypewriter wires to terminals marked **TTY KEY**. If both transmit and receive operations are to be used, also make connections to the terminals marked DC LOOP as directed in instructions for the teletypewriter. Determine the loop drive current required by the teletypewriter (either 20 mA or 60 mA). Connect a 20,000 ohms-per-volt multimeter to the **METER** terminals on the amplifier-converter. Loop both **DC LOOP** and **TTY KEY** terminals with jumper wires. Set meter to read DC current on 100 mA range. Turn the **VOLUME/OFF-MAX** control on the receiver-transmitter clockwise and wait 1 minute for the equipment to warm up. Use a screwdriver to adjust the screw until the meter indicates 20 (20 mA) or 60 (60 mA).


1. ADJUST FOR METER READING 0.20, IF TTY REQUIRES A 20 MA LOOP CURRENT.
2. ADJUST FOR METER READING OF 0.60, IF TTY REQUIRES A 60 MA LOOP CURRENT.
AN/PSM-45
VOLT-OHM METER
SET METER TO ZERO TO 1 VOLT RANGE DC VOLTS
NOTE: ONLY ONE TTY CONFIGUATION MAY BE CONNECTED TO THE AMPLIFIER CONVERTER AT A TIME
TO TELETYPEWRITER FOR TRANSMIT ONLY OPERATION
TO TELETYPEWRITER FOR TRANSMIT/RECEIVE OPERATION
AMPLIFIER-CONVERTER
RECEIVER-TRANSMITTER
EL9XA010

2-5. INITIAL ADJUSTMENTS.

Before applying power and operating the AN/GRC-193A Radio Set, make sure that the interconnect cables are configured for your particular application and that all cable connectors, antenna elements, and equipment covers are in their proper place and tightly connected.

CAUTION

Before operating Radio Set AN/GRC-193A, be sure that antenna coupler and power amplifier air inlets (front of components), and exhaust ports (rear of components) are not obstructed. Overheating can result if this precaution is not observed. Overheating may damage the equipment. The equipment will turn itself off whenever there is a thermal overtemperature condition; however, operation will be delayed.

2-6. ANTENNA SELECTION.

A 15 foot whip antenna consisting of three M-116-A and one each M-117-A and M-118-A sections or one of the optional antennas (the AS-2259, a long wire or a doublet like the GRA-50) can be used with Radio Set AN/GRC-193A, as suitable for the intended use.

A whip antenna is used with the vehicle installations for mobile operation. If a cable is connected to the 50-ohm antenna jack, on the antenna coupler, it must first be disconnected before the whip antenna can be connected. The flag switch must be moved out of the way so that the connection can be made.

CAUTION

Align coupler whip anntenna cable connector before mating and fastening to avoid crossthreading.

If a 50-ohm antenna is used, set up the antenna in accordance with instructions supplied with the antenna. Connect the antenna to jack J3 on the front of the antenna coupler. If a long wire antenna is used, connect it to the antenna base. If, the AS-2259 Antenna is used, connect it to the whip antenna base via Adapter MX-10618/GRC-193A. Make the ground connection to the mounting rack frame.

2-7. POWER SOURCE.

For Radio Set AN/GRC-193A vehicular installations, 26.5 Vdc, nominal, primary power is supplied from the vehicle battery to the DC PWR jack J3 on the front of the PA. For Radio Set AN/GRC-193A installations that do not have a dc power source, connect the primary power cable to Power Supply PP-7333/GRC, or other source of 22 to 30 Vdc power. The equipment will operate with a nominal power supply voltage between 22 and 30 Vdc.

CAUTION

When making connections to the battery terminals of a vehicle, make sure connections are tight. Avoid accidental grounding of positive terminal.

2-8. OPERATING PROCEDURES.

The following paragraphs describe the operating modes and procedures of the AN/GRC-193A Radio Set More detailed information about the individual components is given in their respective equipment operation and maintenance manuals.

2-8.1. Modes of Operation.

Selection of the operational mode is dependent upon tactical requirements. The following conditions are examples of the types of conditions which may be encountered.

2-8.2. Normal Communication.

For two-way voice communication under normal field conditions, the receiver-transmitter should be operated with the receiver-transmitter **MODE** switch set to the **V-TR** position. This selection permits the operator to transmit and receive voice or continuous wave (CW) communication on any of the 280,000 channels.

2-8.3. Radio Silence.

When field conditions require that no radio transmissions be made, the mode selected should be **V-RCV** (voice receive) or **D-RCV** (data receive). These modes prevent accidental transmission of either voice or coded data. The coupler and power amplifier fans are also disabled. When **V-RCV** is selected, the radio set receives voice (or CW), but cannot transmit. When **D-RCV** is selected, the radio set receives data information, but cannot transmit.

2-8.4. Data Communication.

When field conditions require two-way data communication, the receiver-transmitter **MODE** switch is set to **D-TR**. This mode permits transmitting and receiving coded data using a data coding device. The data coding device is connected to the **AUDIO** input jack and the radio set is then used to transmit and receive coded data.

2-8.5. Telegraph Communications.

When Morse code (CW) communication is desired, the receiver-transmitter **MODE** switch is set to **V-TR** (**V-RCV** in radio silence). A telegrapher's key KY-872 is connected to the **AUDIO** input jack on the receiver-transmitter for CW communication.

2-8.6. Teletype Communication.

Two-way communication can be established by connecting a teletypewriter to the amplifier-converter **TTY KEY** or the **DC LOOP** terminals. The receiver-transmitter **MODE** switch is set to **V-TR** and the amplifier-converter **TTY ON** is selected at the amplifier-converter. The radio set is then used to transmit and receive teletype messages.

2-8.7. Secure Voice Communication.

Two-way secure voice communication can be established by utilizing a voice encrypting device such as a Secure Voice Modem KY-65. The radio set can then be used to transmit and receive encryted voice signals.

2-8.8. Loudspeaker/Handset Selection.

The easiest method of communications for the driver/operator is to use the loudspeaker and handset microphone. However, when quiet operation is necessary, the loudspeaker may be shut off by setting the **TTY ON/OFF/SPKR ON** switch to **OFF**, and the handset used to provide two-way voice communication.

2-8.9. Vehicle Installations.

For vehicle installations, start and run the engine of the vehicle to avoid rapid discharge of the batteries, if transmit operation is to be used continuously for an extended period. The vehicle should be located in an unobstructed area, away from trees, buildings, power lines, or other structures and on locally high ground, if possible. Local obstructions or operating in low areas may reduce operating range.

2-8.10. Normal Transmit-Receive Operation (Voice or Data).

WARNING

HIGH VOLTAGES ARE PRESENT ON THE ANTENNA DURING TRANSMISSION. DO NOT TOUCH OR STAND NEAR THE ANTENNA WHEN THE EQUIPMENT IS ENERGIZED.

CAUTION

Avoid operating the transmitter with the antenna touching any natural or man-made object.

CAUTION

Be sure that coupler and power amplifier air inlets (front of the components) and exhaust ports (rear of the components) are not obstructed before operating equipment. Otherwise, overheating may result which would interrupt operation.

1. Set the receiver-transmitter, **TTY ON/OFF/SPKR** on switch to **SPKR ON** and the squelch. Set the **SB** switch to either **LSB** or **USB**, as required for communication with the other station.

NOTE

Both transmitting and receiving radios must be on a common sideband to communicate with each other.

2. Select the **V-TR** position, on the receiver-transmitter, **MODE** switch, for voice, secure voice, CW key, or teletypewriter operation, or select the **D-TR** position, for data operation.

3. Turn the receiver-transmitter **VOLUME** control clockwise about one-quarter turn to apply power and volume to the system. The amber **TUN** lamp on the power amplifier should come on, indicating that the tuning elements in the power amplifier and coupler are homing in preparation for tuning to selected frequency. A beeping will be heard in the handset earpiece. The system is locked into a tune mode during this period and transmission cannot take place.

CAUTION

If the bandswitch motor in the PA runs continuously (audible indication), and the **PA FAULT** light is on, do not attempt further tuning or transmit operation. Switch off and return component for repair.

4. Allow 60 seconds for equipment (power amplifier) warmup; transmission cannot take place during the warmup period. During this period press the **FAN/LAMP TEST** pushbutton on the power amplifier. The blower fans in the power amplifier and coupler should be heard and all lamps on the power amplifier should light. At the end of the 60 second warmup period, the green **RDY** lamp on the power amplifier should come on, and the beeping sound should stop. The **TUN** lamp will remain on.

5. Select the desired operating frequency using the pushbuttons on the receiver-transmitter. The tune mode will again be initiated (as at turn-on) if any frequency pushbutton other than the 100 Hz (farthest right) pushbutton is operated. The **RDY** and **TUN** lamps will remain on.

6. Momentarily press the push-to-talk **(PTT)** switch on the handset. The green **XMT** lamp will come on and the system will automatically tune to the selected frequency within about 6 seconds. A steady tune tone will be heard in the handset earpiece during tuning. At the end of this period the **TUN** and **XMT** lamps should go out and only the green **RDY** lamp on the power amplifier will be on. If either the **PA FAULT** (red) lamp or the **CPLR FAULT** (red) lamp comes on, momentarily switch the **MODE** control on the receiver-transmitter to **V-RCV** and back to **V-TR**. Then press the **PTT** switch on the handset, at least two times. If the fault is of an intermittent nature, it should be cleared by repeating the tuning cycle. If a FAULT indication is still present, after two tune cycles, the system cannot be tuned and will not be able to transmit. Reception can still take place, however, by selecting the receiver-transmitter **MODE** control **V-RCV** position. Use of the **V-RCV** mode is preferred because the fault tone is removed from the audio circuits and will not be heard in the handset earpiece. Refer to a higher level of maintenance for fault troubleshooting and fault isolation at the earliest opportunity.

7. If the amber **FIL** lamp on the power amplifier comes on, a filament in one of the power amplifiers has failed. Transmit operation will still be possible, with reduced power, but the component should be returned to a general support level maintenance facility for tube replacement at the first opportunity.

8. When the system has been tuned to the desired frequency and the green **RDY** lamp is the only indicator lighted on the power amplifier, the system is ready for normal operation.

9. To transmit, press the push-to-talk (PTT) switch on the handset. During transmission, the green **XMT** lamp on the power amplifier should light and the power meter needle should deflect in proportion to the transmit signal, indicating normal power output. Sidetone should be present in the headset earpiece.

10. For speaker operation, select the **SPKR ON** position, on the amplifier-converter **TTY ON/OFF/SPKR ON** selector switch. The speaker is muted during transmission. The **SQUELCH** control can be turned to the **OFF** position or adjusted to squelch noise in the speaker. If squelch is used, adjust the control so that noise is eliminated between received audio signals, but weakest signals that can be distinguished from noise are still audible. Readjust **VOLUME** control on receiver-transmitter as necessary. NOTE: In tactical situations, too much **SQUELCH** may hinder the reception of weak signals.

11. To change frequency, use the digital frequency pushbuttons on the receiver-transmitter to step each digit to the proper value until the correct frequency is displayed on the **FREQUENCY KHz** indicator. Note that the amber **TUN** lamp on the power amplifier comes on when any digit other than 100 Hz is changed, indicating that retuning of the system is necessary (system automatically locked into tune mode). Press the **PTT** switch on the handset (or key the transmitter in some other way) to initiate an automatic tune cycle. The green **XMT** lamp will light. After about 6 seconds, the system is now tuned and ready to operate on the new frequency.

2-8.11. Receive-Only Operation.

1. Make the required handset, headset, teletypewriter, CW key, or secure voice connections for message reception. (See paragraphs 2-4.1 through 2-4.4.)

2. Turn the **SB** switch, on the Receiver/Transmitter, to **USB** or **LSB** as required for communication with the desired station.

3. Select the frequency required for receiving the desired station by pressing the frequency pushbuttons until the display shows the correct frequency.

4. Set the **MODE** selector on the receiver-transmitter to the **V-RCV** position.

5. On the receiver-transmitter, rotate the **VOLUME** control clockwise and wait 1 minute for warmup:

   a. The yellow **TUN** lamp on the power amplifier will come on during warmup.

   b. A beeping will be heard in the handset earpiece and in the speaker during warmup (if turned on).

   c. At the end of one minute, the green **RDY** lamp on the power amplifier will come on and beeping will stop. The **TUN** lamp will remain on.

6. Press the **PTT** switch on the handset.

   a. A steady tuning signal will be heard in the handset earpiece and in the speaker.

   b. The green **XMT** lamp on the power amplifier will come on.

   c. At the end of 6 seconds (or sooner), the **XMT** and **TUN** lamps will go off indicating the set is tuned. Only the **RDY** lamp will remain on.

7. Switch the **MODE** selector on the receiver-transmitter to **V-RCV** for voice, CW teletypewriter, or secure voice reception, or to **D-RCV** for data reception through a matched antenna.

8. If teletypewriter operation is used, set the **TTY ON/OFF/SPKR** on switch on the amplifier-converter to **TTY ON**. If any other mode is being used, set the switch to **OFF** or **SPKR ON**, as desired. If **SPKR ON** is selected, the amplifier-converter **SQUELCH** control can be used to reduce background noise. Set the control at the position that permits received signals to be heard while squelching noise between signal receptions.

2-9. OPERATING TECHNIQUES.

Use standard call procedures prescribed by the Appropriate ACP. To minimize pick-up and transmission of acoustic noise, the operator should hold the microphone close to his lips and should stand as far as possible from any sources of noise, such as the vehicle engine.

SECTION IV OPERATION UNDER UNUSUAL CONDITIONS

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Operation in Extreme Cold	2-11	2-22
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General Information	2-14.1	2-23
Installation of Tactical Remoting Kit	2-14.2	2-24
Installation of Antenna AS-2259	2-14.3	2-25
Installation of Radio Set Control Group AN/GRA-39C	2-14.4	2-28
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2-10. RECEIVE-ONLY OPERATION WITH UNTUNED, UNMATCHED ANTENNA.

1. Make the required handset, headset, teletypewriter, CW key, or secure voice connections for message reception (See paragraphs 2-4.1. through 2-4.4.).

2. On the receiver-transmitter, select the **USB** or **LSB** position of the **SB** switch, as required for communicating with the desired station.

3. Select the frequency required for receiving the desired station by pressing the frequency pushbuttons until the **FREQUENCY KHz** display on the receiver-transmitter shows the correct frequency.

4. Switch the **MODE** selector on the receiver-transmitter to **V-RCV** for voice, CW teletypewriter, or secure voice reception, or to **D-RCV** for data reception through a matched antenna.

5. If teletypewriter operation is used, set the **TTY ON/OFF/SPKR ON** switch on the amplifier-converter to **TTY ON**. If any other mode is being used, set the switch to **OFF** or **SPKR ON**, as desired. If SPKR ON is selected, the amplifier-converter **SQUELCH** control can be used to reduce background noise. Set the control at the position that permits received signals to be heard while squelching noise between signal receptions.

2-11. OPERATING IN EXTREME COLD.

When operating the AN/GRC-193A in extremely cold weather, keep ice and snow from building up on antenna. Be sure to keep unused receptacles covered with electrical tape (item 4, appendix E). Do not bend whip antenna sections or cables as cracking or other forms of wear can result. Be careful when tying down or releasing whip antenna. Proceed slowly to prevent cracking.

2-12. FORDING.

On all vehicle installations, before fording, check to see that all seals are tightly installed.

2-13. EMERGENCY OPERATION.

1. The equipment can be operated temporarily from a 24-volt battery (or in the case of a vehicle installation, with the vehicle engine turned off) by limiting transmit operation. This can be

accomplished best by informing the other stations of the condition so that they can communicate in ways requiring only brief responses. Receive-only operation can be used to conserve power. See untuned receive-only mode description, paragraph 2-10.

2. If the normal power source cannot be used emergency power can be obtained for a limited time from two series-connected 12-volt batteries, for a total of 24 volts.

3. An emergency antenna, any length of wire (the longer and the higher above ground the better) or two or three sections of a vertical whip antenna can be used.

2-14. REMOTE ANTENNA SITING.

The Tactical Antenna Remoting Kit, P/N 755017B0771, enhances the operational flexibility of the 400 watt HF AN/GRC-193A Radio Set by making it possible to remote (up to 200 feet) the CU-2064/193A Antenna coupler and the antenna from the radio set for:

1. Optimum siting of the antenna at an elevated clear area.

2. Concealment and/or protection of the operator and the radio set.

3. Separation of antennas at a communications complex for minimum interference between radio sets.

2-14.1. General Information.

The Tactical Antenna Remoting Kit consists of:

- Two cables (200 feet long) stored on an RC-435/U cable reel. One cable, P/N 755017B0110, replaces the PA-CU Control Cable used with most equipment installations. The other cable, P/N 755017B118, replaces the PA-CU RF Coaxial cable used with most equipment installations. All connectors are provided with protective caps.

- Coupler and Antenna Base Plate, P/N 755017B769, provides a mounting platform with quick fasteners (2 thumbscrew clamps) for the CU-2064 Antenna Coupler and the AB-652 Antenna Base at the remote antenna site. This assembly is called Mounting Base MT-6378/GRC-193A. The AB-652 Antenna Base can be folded down for storage to minimize overall size of the mount.

- A ground rod and a grounding strap.

- Antenna Adapter, P/N 755017B0765, not part of the Tactical Antenna Remoting Kit, permits the whip or other antennas to be replaced with the Near Vertical Incidence Skywave (NVIS) antenna AS-2259. The AS-2259 (NVIS) antenna radiates a skywave that is nearly vertical and will clear nearby obstructing ground clutter. The skywave is reflected to the ground from the ionosphere at short distances from the radiating antenna without introducing large skip distances between the transmitting and receiving stations. Multiple reflections between the ionosphere and the earth provide considerable range of coverage using the NVIS antenna in spite of the short skip distance.

NOTE

Remoting the antenna farther than 200 feet is possible by selecting a lower loss rf cable, provided the increase in bulk and weight of the remoting cables and the need for separate reels for the control cable and the rf cable is acceptable.

NOTE

The effectiveness of the antenna used (particulatly whips) can be improved by the use of ground rods and radials.

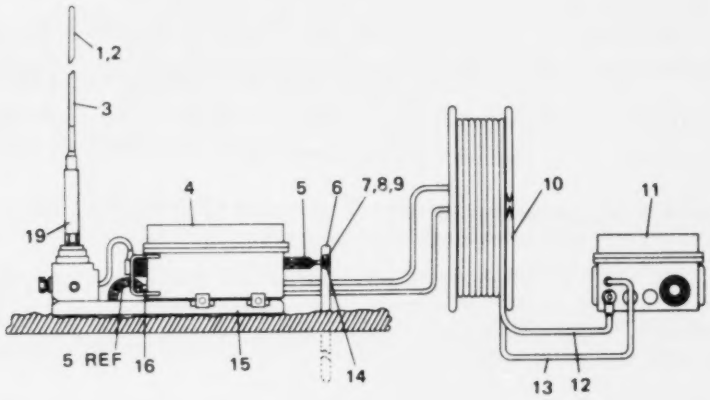
2-14.2. Installation of Tactical Remoting Kit.

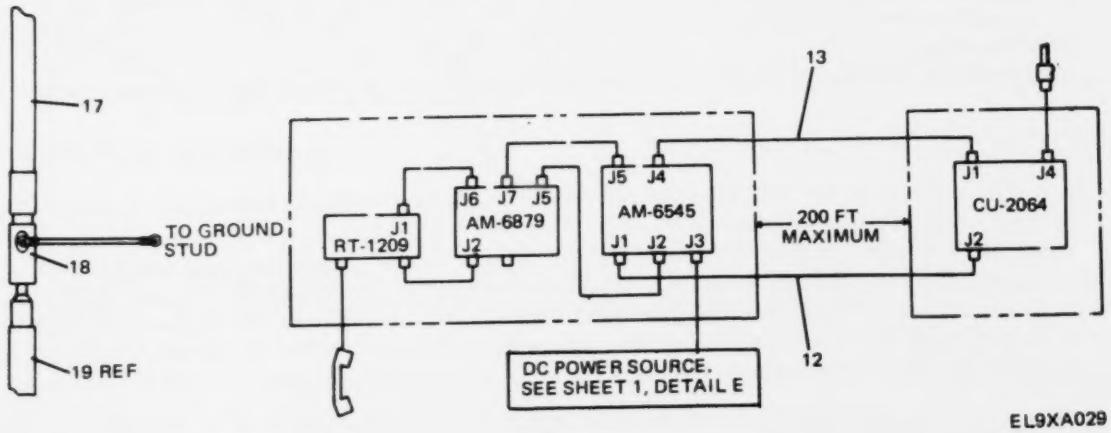
To install the tactical remoting kit proceed as follows:

NOTE

Observe all Warnings and Cautions while performing this procedure.

1. When the antenna (items 1, 2, and 3) must be remotely located from the radio set, select a site within 200 feet of the radio set that is free of obstructions for a distance of 75 feet in the desired direction of transmission.





2. Place the Mounting Base MT-6378/GRC-193A (item 15) at the selected antenna location.

3. At Power Amplifier AM-6545A-193A, make sure power is not applied to any of the units of the AN/GRC-193A Radio Set, by disconnecting the primary power cable at DC PWR jack J3 on the power amplifier.

4. Disconnect all cables, ground straps, and thumbscrew clamps that restrain Antenna Coupler CU-2064/193A (item 4) in the equipment rack or equipment mount.

5. Remove the antenna coupler from the rack/mount and carry it to the antenna site location. Observe the two person rule, the antenna coupler weighs approximately 41 pounds (18.6 kg).

6. Place the cable reel (item 10), on which the rf coaxial cable (item 13) and the control cable (item 12) are rolled, near the vehicle or shelter where the radio set is located. Observe the two person rule, the cable reel and cables weigh approximately 75 pounds (34.09 kg).

7. Unreel the antenna coupler ends of both cables toward the remote antenna site. Connect RF Coaxial cable (item 13) connector (labeled P1) to antenna coupler jack J1 and control cable (item 12) connector (labeled P2) to antenna coupler jack J2.

8. Erect the AB-652 Antenna Base (item 19) by loosening the two thumbscrews and rotating the base on the mount to the vertical position. Tighten the thumbscrews firmly.

9. Place Antenna Coupler CU-2064/GRC-193A (item 4) on the Mounting Base MT-6378/GRC-193A (item 15) and attach firmly, using four thumbscrew clamps on the mounting base.

10. Drive ground rod (item 6) into the earth firmly, using a sledgehammer (item 12 Appendix D) and attach ground strap (item 5) between either of the ground studs on the antenna coupler (item 4) and the ground rod (item 6), using the wingnut fasteners. Tighten the wingnuts firmly.

11. Connect the Radio Set end of the 200 foot long rf coaxial cable (item 13), whose connector is labeled P2, to jack J4, on the Power Amplifier (item 11).

12. Connect the Radio Set end of the 200 foot long control cable (item 12), whose connector is labeled P1, to jack J1, on the power amplifier (item 11).

13. If the Near Vertical Incidence Skywave (NVIS) Antenna AS-2259 is to be installed proceed to 2-14.3. If the regular antenna used for mobile operation is to be used, connect the antenna sections to the AB-652 Antenna Base (item 19) as usual.

2-14.3. Installation of Antenna AS-2259.

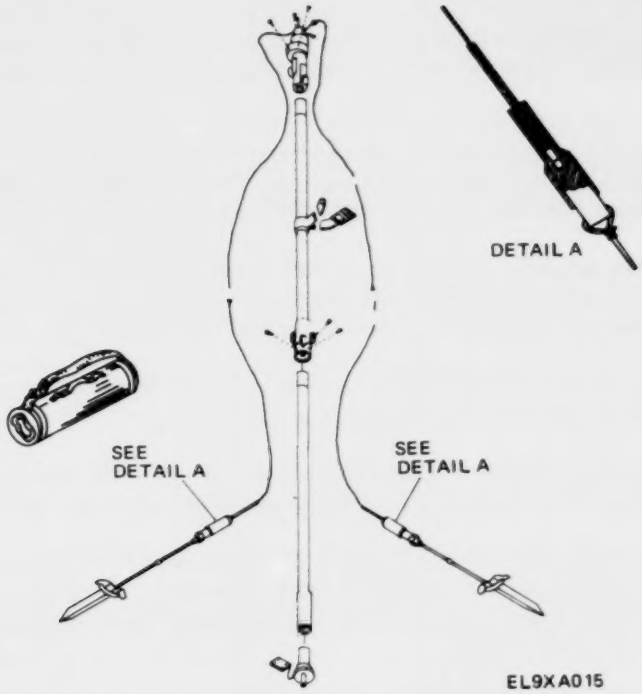
WARNING

BE SURE RADIO SET AN/GRC-193A POWER IS OFF BEFORE PROCEEDING WITH ANTENNA ASSEMBLY.

a. General. The AS-2259/GR HF Antenna is essentially a dipole antenna fed with a low-loss, foam-dialectric, coaxial mast that also serves as support structure. The dipole system uses a set of crossed sloping dipoles positioned at right angles to each other. Physically, the antenna consists of eight

light-weight coaxial mast sections and four radiating elements that also serve as guys. The antenna is transported in a canvas pack whose total weight is 14.7 pounds (32.34 kg). Erections can be accomplished by two persons in five minutes without the use of any tools.

b. Operation. The 637K-1 is designed to replace a whip antenna when path loss or terrain masking make surface wave propagation impractical. The 637K-1 provides a radiation pattern that is straight up for the 2.0 to 20.0 MHz band. This provides excellent short range skywave communication from 0 to 300 miles.



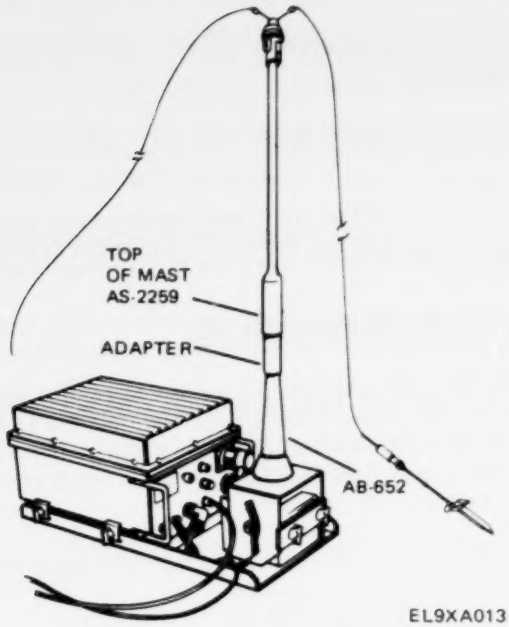
c. Installation. To install the AS-2259 Antenna, proceed as follows:

1. The AS-2259/GR Antenna requires a semipermanent installation remotely located from the radio set. If the tactical antenna site remoting kit has already been installed, continue. If it has not, proceed to paragraph 2-14.2 , do the remote installation procedure, then return to this procedure.

2. Remove all of the whip antenna sections from the AB-652 Antenna Mast Base on the remote mounting plate.

3. Screw Antenna Adapter, P/N 755017B0765 (item 18) firmly onto Antenna Mast Base AB-652 (item 19).

4. Install top mast assembly onto the antenna adapter and uncoil elements.



5. Measure anchor positions using plastic cable markers as guides and install stake anchors.

NOTE

Before connecting mast sections be sure to wipe unpainted surfaces clean of mud or dirt.

6. Assemble mast by raising top mast assembly in one hand and inserting a mast section into it, using the other hand. Continue to raise the assembled mast sections, inserting a new section into the section above it until all of the coaxial mast sections have been assembled.

7. Screw the whole assembled mast onto the antenna adapter (item 18), using screws provided in the antenna kit.

8. Adjust tension on all elements (guy wires) until mast is plumb. Elements need not be excessively taut.

9. Make sure that all cable connectors are firmly tightened and that the antenna is not in danger of touching tree limbs or any other obstructions before applying power to the Radio Set AN/GRC-193A.

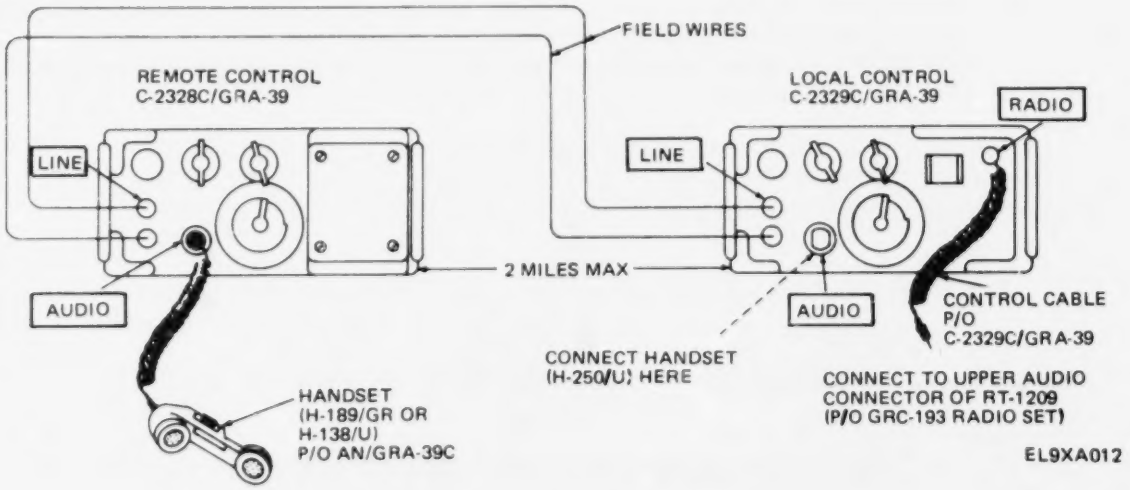
2-14.4. Installation of Radio Set Control Group AN/GRA-39C.

The Radio Set Control Group AN/GRA-39C provides the means to control the remoter operation of the tactical radio set. It includes the C-2328C/GRA-39 Remote Control Unit, the C-2329C/GRA-39 Local Control Unit, Handset H-189/GR, and Carry Bag CW-598/GRA-39 (a bag and a carrying sling). The local and remote units have additional rf filtering of field wire lines to assure troublefree operation in close proximity to high power HF transmitters.

1. Disconnect the H-250/U handset, control cable, from the upper **AUDIO** jack, on the receiver-transmitter.

2. Connect the control cable of the local unit, the C-2329C/GRA-39, to the upper **AUDIO** jack on the receiver-transmitter.

3. Connect the H-250/U Handset, control cable, to the **AUDIO** jack on the C-2329C/GRA-39 Local Control Unit.



4. The remote unit, C-2329C/GRA-39, may be situated up to two miles from the radio set and is connected to the **LINE** terminals of the local unit by 600-ohm field wire, which is connected to the **LINE** terminals of the remote unit. NOTE: It does not make any difference which wire is connected to which **LINE** terminal on the local and remote control units.

5. Connect the control cable of the H-189/GR Handset, supplied with the AN/GRA-39C, to the **AUDIO** jack of the C-2329C/GRA-39 Remote Control Unit.

6. Voice communications can be received and transmitted through the radio set and can be controlled either locally or remotely at the option of the operators.

7. The remote unit contains a loudspeaker to monitor all received radio signals. The volume is controlled by the VOLUME control knob on the receiver-transmitter.

2-14.5. Installation of Doublet Antenna AN/GRA-50.

WARNING

DANGEROUS VOLTAGES EXIST ON THE ANTENNA WHEN IN OPERATION

WARNING

BE SURE RADIO SET AN/GRC-193A POWER IS OFF BEFORE PROCEEDING WITH ANTENNA ASSEMBLY

a. General. The AN/GRA-50 Antenna Group is a doublet antenna furnished with Radio Set AN/GRC-139A, that may be used instead of the whip antenna when operating from a fixed or semifixed location to provide greater directivity and signal pickup. Each antenna should be positioned broadside to the direction of transmission or reception.

b. Planning Antenna Sites. The length of coaxial cable limits the distance that the Radio Set may be from the center of the transmitting antenna to about 150 feet. For each antenna it is desirable to have a clear, level area, the size of which is determined by the lowest frequency of the radio. For example, at 1.5 MHz, each antenna will require an area of 200 feet by 50 feet, the long dimension being perpendicular to the direction of transmission or reception. At 18 MHz, each antenna will require an area of 80 by 50 feet.

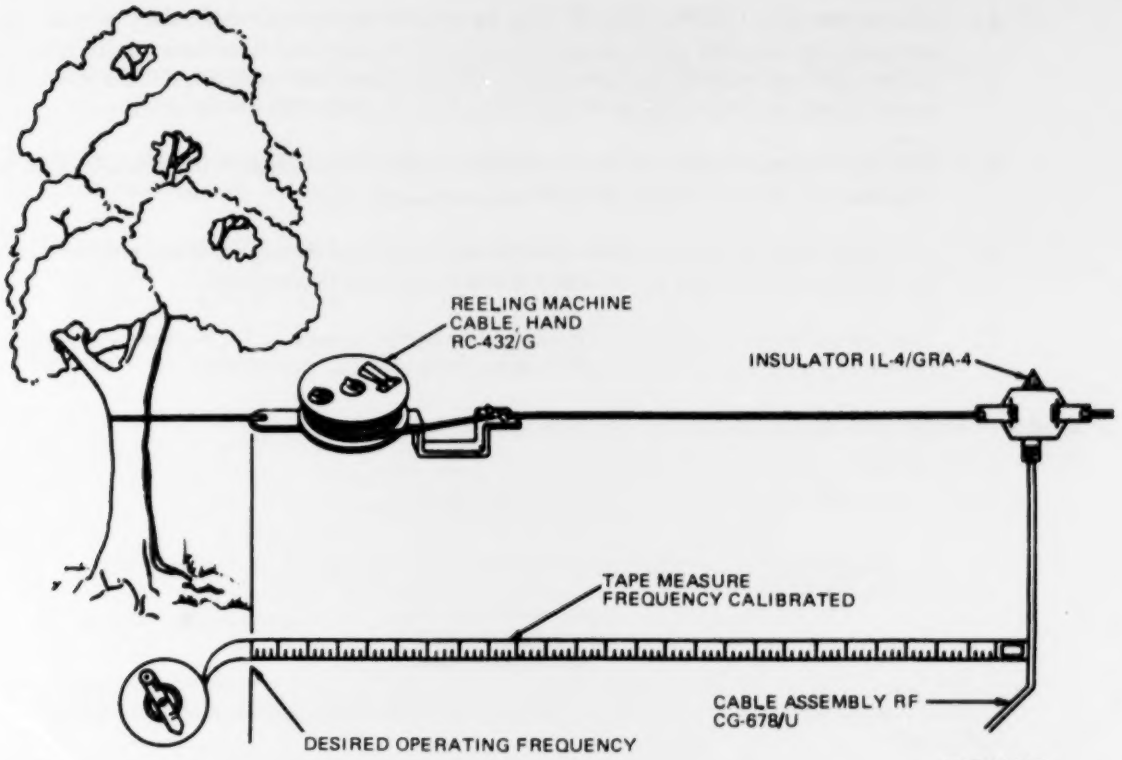
c. Installation Procedure. To install the AN/GRA-50 Antenna proceed as follows:

1. Connect the antenna wire terminal hooks to the thumb nuts on the opposite ends of the insulator.

2. Temporarily fasten the insulator to one of the desired supports.

3. Temporarily fasten the free end of the tape measure to the center of the insulator.

4. Unwind the tape measure to the length corresponding to the desired frequency.



5. Unroll a like amount of wire from each reel assembly as follows:

   a. Grasp the reel assembly firmly in one hand and loosen the thumb nut at the center of the reel and the thumb nut on the wire clamp on the reel assembly frame.

   b. Move avay from the antenna center slowly, keeping the wire taut at all times. Hold your thumb on the wire to prevent backlash.

   c. After unwinding the required amount of wire, tighten the thumb nut on the wire clamp.

   d. Tighten the thumb nut at the center of the reel.

6. Unfasten the tape measure from the insulator, unfasten the insulator from the support, and lay the antenna wires out in a straight line.

7. Check the overall length of the two wires plus the insulator and reel assemblies. The overall length will be twice the length indicated on the tape measure for the desired frequency. Adjust the antenna for overall length. Be sure to keep the insulator centered.

8. Attach each reel assembly to a halyard snaphook fastener.

9. Tie the halyards to the best available supports (tree, fence post, vehicle, etc.) at a height of 4 feet or higher.

NOTE

Allow the antenna assembly to sag at least 6 inches.

10. Connect the ends of the rf cable between the insulator connector and the antenna connector on the radio set. Shorten or lengthen the antenna assembly a few inches at a time when difficulty in transmitter loading is encountered.

CHAPTER 3

OPERATOR MAINTENANCE INSTRUCTIONS

Subject	Section	Page
Operator Troubleshooting Procedures	I	3-1
Operator Maintenance Procedures	II	3-8
Functional Description	III	3-8

Section I OPERATOR TROUBLESHOOTING PROCEDURES

Subject	Para	Page
General	3-1	3-1
Operator Troubleshooting		3-1

3-1. GENERAL.

The troubleshooting table lists problems you may find when operating the AN/GRC-193 A Radio Set.

The troubleshooting does not list all of the problems which you may find. If your problem is not listed, or if the troubleshooting steps do not solve your problem, report your problem to a higher level of maintenance.

When working on any problem, be sure to report your work on forms shown in DA Pam 738-750.

OPERATOR TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. No bandswitching noise heard in PA. Change frequency by 10,000 kHz (do not go outside 2 to 30 MHz). If sympton still persists, contact higher maintenance category.
2. No noise from handset earpiece. Switch handset with one that you know is working. Change handset.

OPERATOR TROUBLESHOOTING (CONTINUED)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
3. No noise from speaker (AM-6879/URC). Check to see if the AM-6879 Amplifier-Converter speaker is turned off. Turn speaker on. Check to see if the AM-6879 Amplifier-Converter SQUELCH is set too high. Turn SQUELCH down (counterclockwise). Check to see if the AM-6879 Amplifier-Converter is faulty. Higher maintenance category required.
4. Clicking sound in handset earpiece. Have higher maintenance category check input voltage to Radio Set AN/GRC-193A. Possible low input voltage (below 20 Vdc). Voltage should be 26.5 Vdc. Higher maintenance category required.
5. Fault tone at power turn on. Normal indication during warm-up. Wait one minute, tone should cease at end of warm-up. If fault tone persists, possible faulty Amplifier-Converter (AM-6879) or Antenna Coupler (CU-2064), higher maintenance category required.
6. No YELLOW tune light on Power Amplifier (AM-6545A). Press FAN/LAMP TEST push button on Power Amplifier (AM-6545A). All six PA lamps will come on and the fans in Power Amplifier (AM-6545A) and the Antenna Coupler (CU-2064) will be heard. If not, higher maintenance category required. Possible high input voltage (over 32 Vdc) or possible low input voltage (below 20 Vdc).
7. No GREEN RDY light on Power Amplifier (AM-6545A) after one minute warm-up. Faulty Power Amplifier (AM-6545A). Higher maintenance category required.

OPERATOR TROUBLESHOOTING (CONTINUED)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
8. No steady tune signal in handset or speaker when handset PTT switch is pressed.
Check to see if the Amplifier-Converter (AM-6879) speaker switch is turned off.
Switch the Amplifier-Converter (AM-6879) TTY ON/OFF/SPKR ON switch to the SPKR ON position.
If Amplifier-Converter (AM-6879) speaker condition persists, possible faulty speaker.
Higher maintenance category required.
Switch handset with one that you know is working.
Change handset.
9. No GREEN XMT lamp on Power Amplifier (AM-6545A) when handset PTT switch is pressed.
Switch handset with one that you know is working.
Change handset.
Condition persists after replacing handset, possible faulty Amplifier-Converter (AM-6879).
Higher maintenance category required.
Condition persists after replacing handset, possible faulty Power Amplifier (AM-6545A).
Higher maintenance category required.
10. REF FIL FAULT lamp on Power Amplifier (AM-6545A) comes on.
Power Amplifier tube in Power Amplifier (AM-6545A) is defective.
NOTE
Operation at reduced power is still possible, but the Power Amplifier unit (AM-6545A) should be returned to a higher maintenance category for repair at the first opportunity.
Higher maintenance category required.

OPERATOR TROUBLESHOOTING (CONTINUED)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
11. RED PA FAULT lamp on Power Amplifier (AM-6545A) comes on.
Check to see if the antenna is installed.
Higher maintenance category required to install antenna.
Check Antenna Cable (SM-C-582924) for breaks, cracks, and proper connection.
Higher maintenance category required to replace antenna cable (SM-C-582924).
Check W6 Control Cable Assembly (75501780732) for breaks, cracks, and proper connection.
Higher maintenance category required to replace W6 control cable (75501780732).
Check W5 Coaxial Cable Assembly (75501780716) for breaks, cracks, and proper connection.
Higher maintenance category required to replace W5 coaxial cable (75501780716).
Possible faulty Antenna Coupler (CU-2064).
Higher maintenance category required to replace Antenna Coupler (CU-2064).
Possible faulty Power Amplifier (AM-6545A).
Higher maintenance category required to replace Power Amplifier (AM-6545A).
12. RED CPLR FALULT lamp on Power Amplifier (AM-6545A) comes on.
Check to see if the antenna is installed.
Higher maintenance category required to install antenna.
Check Antenna Cable (SM-C-582924) for breaks, cracks, and proper connection.
Higher maintenance category required to replace antenna cable (SM-C-582924).

OPERATOR TROUBLESHOOTING (CONTINUED)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
12. RED CPLR FAULT lamp on Power Amplifier (AM-6545A) comes on. (Continued)
Check W6 Control Cable Assembly (755017B0732) for breaks, cracks, and proper connection.
Higher maintenance category required to replace W6 control cable (755017AB0732).
Check W5 Coaxial Cable Assembly (7501TB0716) for breaks, cracks, and proper connection.
Higher maintenance category required to replace W5 coaxial cable (75501TB0716).
Possible faulty Antenna coupler (CU-2064).
Higher maintenance category required to replace Antenna Coupler (CU-2064).
Possible faulty Power Amplifier (AM-6545A).
Higher maintenance category required to replace Power Amplifier (AM-6545A).
13. Power Amplifier (AM-6545A) internal bandswitch rotates continuously and will not stop.
Faulty Power Amplifier (AM-6545A).
Higher maintenance category required to replace Power Amplifier (AM-6545A).
14. Radio Set shuts down during operation.
Check to see if the air intake and output louvers at the front and rear of both the power amplifier and the antenna coupler are blocked. A possible thermal breakdown condition may exist causing the radio to shut down if the internal temperature reaches 55° (131°).
Remove any obstacles blocking the air louvers.

OPERATOR TROUBLESHOOTING (CONTINUED)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
15. Meter on Power Amplifier (AM-6545A) does not deflect when speaking into handset.
Switch handset with one that you know is working.
Change handset.
Check W2 Control Cable Assembly (755017B0736) for breaks, cracks, and proper connection.
Higher maintenance category required to replace W2 control cable (755017B0736).
Faulty meter on Power Amplifier (AM-6545A).
Higher maintenance category required to replace Power Amplifier (AM-6545A).
16. No power to Amplifier-Converter.
Check fuse F1 on front panel of Amplifier-Converter.
Replace fuse F1, if blown, with spare fuse located on rear of unit.
Check W2 Control Cable Assembly (755017B0736) for breaks, cracks, and proper connection.
Higher maintenance category required to replace W2 control cable (755017B0736).
17. No transmission or reception.
Turn off rf and check antenna mast.
Tighten antenna elements.
Check Antenna Cable (SM-C-582924) for breaks, cracks, and proper connection.
Higher maintenance category required to replace antenna cable (SM-C-582924).
Check W6 Control Cable Assembly (755017B0732) for breaks, cracks, and proper connection.
Higher maintenance category required to replace W6 control cable (755017B0732).

OPERATOR TROUBLESHOOTING (CONTINUED)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
17. No transmission or reception. (Continued) Check W5 Coaxial Cable Assembly (755017B0716) for breaks, cracks, and proper connection. Higher maintenance category required to replace W5 coaxial cable (755017B0716). Check to see if Power Amplifier (AM-6545A) PA RDY lamp is on. If PA RDY lamp is not on, contact higher maintenance authority. If PA RDY lamp is on, proceed to next step. Check to make sure the PA FAN/LAMP TEST switch function works. If yes, problem is in either the Amplifier-Converter or the Receiver-Transmitter. Contact higher maintenance category. If no, go to next step. Check PA Primary input power connector P3, to see if it is attached correctly. If no, reconnect PA primary input power connector P3. If yes, problem in power source. Contact higher maintenance category.

Section II OPERATOR MAINTENANCE PROCEDURES

Subject	Para	Page
Cleaning	3-2	3-8
Tightening	3-3	3-8

3-2. CLEANING.

WARNING

Adequate ventilation should be provided while using **TRICHLOROTRIFLUOROETHANE**. Prolonged breathing of vapors should be avoided. The solvent should not be use near heat or open flame; the products of decomposition are toxic and irritating. Since **TRICHLOROTRIFLUOROETHANE** dissolves natural oils, prolonged contact with skin should be avoided. When necessary, use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

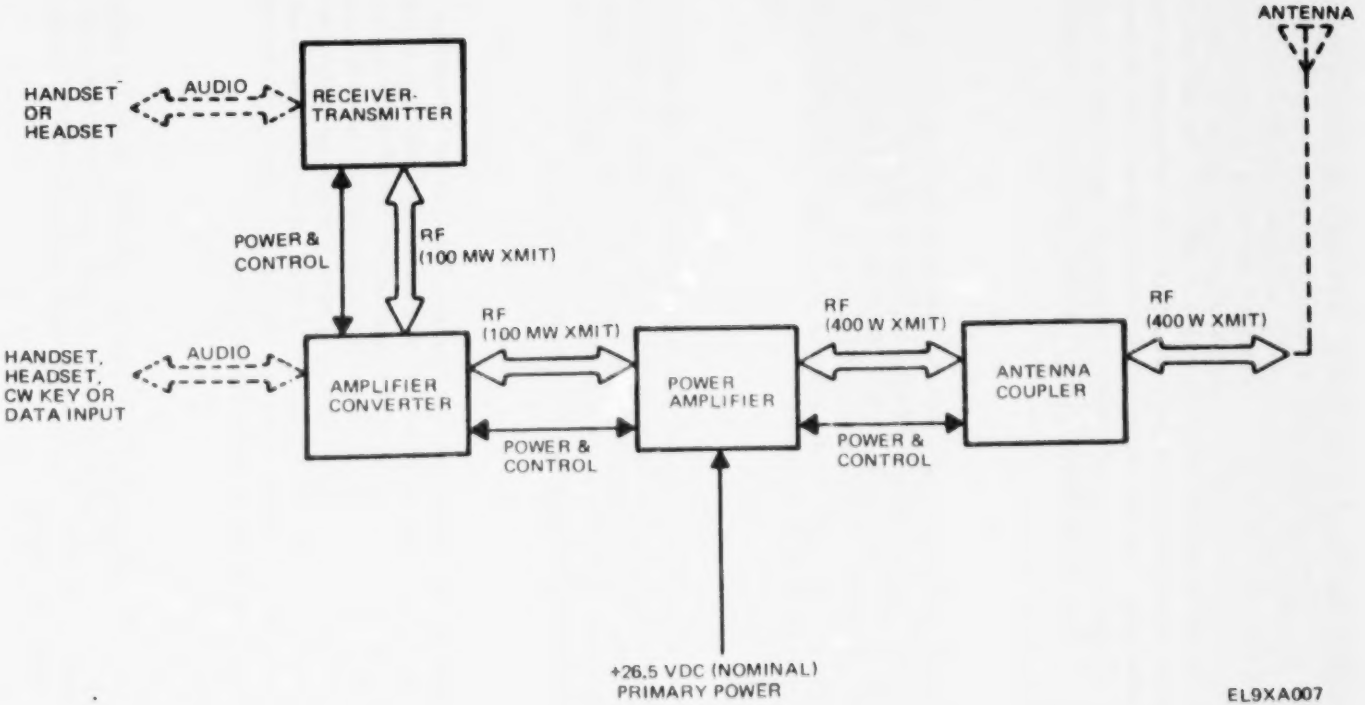
1. Turn AN/GRC-193A Radio Set power off at the **RT VOLUME** control.
2. Remove dirt from surface with a clean cloth.
3. Using a rag dampened with **TRICHLOROTRIFLUOROETHANE**, remove grease, fungus, and ground-in dirt from metal surfaces only.

3-3. TIGHTENING.

1. Tighten all hardware, including mounting hardware.
2. Check and tighten all cable connections.

Section III FUNCTIONAL DESCRIPTION

Subject	Para	Page
Block Diagram Description	3-4	3-10
Operation	3-4.1	3-10
Receive Operation	3-4.2	3-10
Tuning	3-4.3	3-10
Primary Power	3-4.4	3-10
Power Amplifier and Antenna Coupler Cooling	3-4.5	3-10
Indicators	3-4.6	3-11
Protective Circuits	3-4.7	3-11


ANTENNA
HANDSET OR HEADSET
AUDIO
RECEIVER-TRANSMITTER
POWER & CONTROL
RF (100 MW XMIT)
HANDSET, HEADSET, CW KEY OR DATA INPUT
AUDIO
AMPLIFIER CONVERTER
RF (100 MW XMIT)
POWER & CONTROL
POWER AMPLIFIER
RF (400 W XMIT)
POWER & CONTROL
ANTENNA COUPLER
RF (400 W XMIT)
+26.5 VDC (NOMINAL) PRIMARY POWER
EL9XA007

3-4. BLOCK DIAGRAM DESCRIPTION.

The following is a functional description of the AN/GRC-193A Radio Set showing the system relationship of the units to the radio set. The transmitting and receiving paths are indicated by broad lines. Control and power distribution are indicated by narrow lines. All operation controls are located on the receiver-transmitter and amplifier-converter, and all system operating functions originate in those units. Receiver-transmitter control functions include system power application, frequency selection, operating mode selection and modulation mode selection. In addition, the receiver-transmitter front panel controls provide for setting the receive audio volume level to the handset or speaker and for receiver-transmitter lamp tests. Amplifier-converter controls include selection of speaker or **TTY ON** operation and speaker **SQUELCH** control. A handset or headset can be connected to either the amplifier-converter or the receiver-transmitter. CW Key or data input/output connections are made at the amplifier-converter.

3-4.1. Operation.

During operation, when the push-to-talk switch on the handset is depressed, the audio signals are amplitude modulated on the lower or upper sideband of the selected carrier frequency generated by the receiver-transmitter. With a 100 milliwatt input, the power amplifier raises the output power level to 400 watts (held constant within ± 1 dB by an automatic level control circuit). The power amplifier output is coupled by the antenna coupler to the antenna. The antenna is matched by the coupler to the 50-ohm output impedance of the power amplifier.

3-4.2. Receive Operation.

During receive operation, when the push-to-talk switch on the handset is released (or in the receive-only mode of operation), received signals are coupled from the antenna to the power amplifier where they are bypassed around the amplifier circuits directly to the receiving circuitry in the receiver-transmitter. Received signals are down converted and demodulated and the audio output is sent to the handset or to the speaker amplifier in the amplifier-converter.

3-4.3. Tuning

Tuning of the power amplifier and coupler is fully automatic. The receiver-transmitter output is held at a low level during tuning. Initial tuning (bandswitching of the power amplifier and homing of the coupler tuning elements) takes place in response to power turn-on or to frequency selection at the receiver-transmitter. Fine tuning is initiated by momentarily keying the transmitter (push-to-talk) and takes place within about six seconds. Coupler fine tuning follows power amplifier fine tuning. When tuning is completed, the coupler VSWR is less than 1.2:1. The power level is then raised automatically to the full output wattage for normal transmit operation. The power output of the AN/GRC-193A Radio Set is determined by the position of the PA **400W-100W** switch.

3-4.4. Primary Power.

Primary power at 26.5 Vdc (nominal) is applied to the power amplifier. When the radio set is turned on at the receiver-transmitter, power is distributed from the power amplifier to the coupler, the receiver-transmitter, and the amplifier-converter. The high voltage dc-to dc converter in the power amplifier is turned on only during transmitter keying.

3-4.5. Power Amplifier and Antenna Coupler Cooling.

The power amplifier and coupler are cooled by forced air/convection cooling systems. In the power amplifier, heat is transferred by convection to a finned heat exchanger in the bottom of the electronics compartment. The heat exchanger fins are cooled by a thermostatically controlled fan located outside the electronics compartment. Cooling air enters the component at the front and is exhausted at the rear of the unit. The coupler is cooled by a continuous-duty fan located inside the electronics compartment to distribute the internal heat, and by a heat exchanger and an external thermostatically controlled fan.

3-4.6. Indicators.

Indications of tuning progress, tuning completed, transmitter in operation, tuning faults, filament failure (in power amplifier) and output power are provided on the power amplifier front panel. Refer to Chapter 2, Section I, paragraph 2-1 for a description of operator controls and indicators.

3-4.7. Protective Circuits.

Protective circuits prevent transmission if the supply voltage is excessive or if the coupler or power amplifier is untuned or there is a tuning fault in either unit. Excessive temperature or supply voltage will also fault the system and remove system power. Power is automatically reset when equipment temperature or voltage is restored to normal.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Subject	Section	Page
Repair Parts; Special Tools; Test, Measurement, and Diagnostic Equipment (TMDE); and Support Equipment	I	4-1
Organizational Preventive Maintenance Checks and Services (PMCS)	II	4-2
Organizational Troubleshooting Procedures	III	4-4
Organizational Maintenance Procedures	IV	4-11

Section I REPAIR PARTS; SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

Subject	Para	Page
Common Tools and Equipment	4-1	4-1
Special Tools, TMDE, and Support Equipment	4-2	4-1
Repair Parts	4-3	4-1

4-1. COMMON TOOLS AND EQUIPMENT.

The following is a complete listing of common tools and equipment used during organizational maintenance functions. Another list is given in the Maintenance Allocation Chart (MAC) in appendix B at the back of this manual.

ORGANIZATIONAL MAINTENANCE TOOL LIST

NOMENCLATURE	NSN
TOOL KIT, ELECTRONIC EQUIPMENT, TK-101/G	5180-00-064-5178
MULTIMETER, DIGITAL AN/PSM-45	6625-01-139-2512

4-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

Refer to **TM 11-5820-924-24P** for special tools, TMDE, and support equipment.

4-3. REPAIR PARTS.

Repair parts for organizational maintenance of the AN/GRC-193A Radio Set are listed and illustrated in the repair parts and special tools list in **TM 11-5820-924-24P.**

Section II ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Subject	Para	Page
General	4-4	4-2
Organizational Preventive Maintenance Checks and Services (PMCS)		4-3

4-4. GENERAL.

Organizational preventive maintenance procedures are designed to help maintain the AN/GRC-193A Radio Set in serviceable condition. The PMCS procedures listed in this section are all checks to be done at quarterly intervals. The routine covering of unused receptacles, stowing unused equipment, and procedures such as equipment inventory, cleaning of components, checking for frayed cables and loose nuts, bolts, and screws as well as touchup painting are not listed in the PMCS table. These things you should do any time you see they must be done. If you find a routine check in the PMCS, it was listed because other technicians reported problems with this item.

If the equipment fails to operate, refer to organizational troubleshooting steps in this manual. Use DA Pam 738-750 as a guide for reporting problems and using forms.

The ITEM NO. column in the PMCS table is to be used as a source of item numbers for the TM number column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, for recording PMCS results. The organizational PMCS Procedures listed are quarterly equipment checks.

NOTE

Always keep in mind the warnings and cautions when doing PMCS or routine checks.

ORGANIZATIONAL QUARTERLY PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

ITEM NO.	ITEM TO BE INSPECTED	PROCEDURES
1	Receiver-Transmitter **VOLUME** control knob	Check to see if RT **VOLUME** control knob is loose, missing, or damaged. If so tighten or replace knob.
2	Receiver-Transmitter **SB** (Sideband) control knob	Check to see if RT **SB** control knob is loose, missing, or damaged. If so tighten or replace knob.
3	Receiver-Transmitter **MODE** control knob	Check to see if RT **MODE** control knob is loose, missing, or damaged. If so tighten or replace knob.
4	Amplifier-Converter **TTY ON/OFF/SPKR ON** control knob	Check to see if AMPL-CNVTR **TTY/SPKR** control knob is loose, missing, or damaged. If so tighten or replace knob.
5	Amplifier-Converter **LOOP CURRENT SELECT** control knob	Check to see if AMPL-CNVTR **LOOP CURRENT SELECT** control knob is loose, missing or damaged. If so tighten or replace knob.
6	Power Amplifier **CB1** rubber boot	Check to see if **PA CB1** seal boot is torn, cracked, split, or missing. If so, notify a higher maintenance authority.
7	Power Amplifier **CB2** rubber boot	Check to see if **PA CB2** seal boot is torn, cracked, split, or missing. If so notify a higher maintenance authority.
8	Power Amplifier S1 **AN/LAMP TEST** switch	Check to see if PA S1 **AN/LAMP TEST** seal boot is torn, cracked, split, or missing. If so notify a higher maintenance authority.
9	Power Amplifier M1 meter glass	Check to see if PA M1 meter glass is cracked, or missing. If so notify a higher maintenance authority.

Section III ORGANIZATIONAL TROUBLESHOOTING PROCEDURES

Subject	Para	Page
General	4-5	4-4
Organizational Troubleshooting		4-4

4-5. GENERAL.

The troubleshooting table lists malfunctions that may be found during PMCS or when the equipment is being operated.

The troubleshooting table does not list all of the problems which may occur. If your problem is not listed, or if the procedures given do not correct the problem, report it to a higher level of maintenance.

When working on any problem, be sure to report your work on the forms shown in DA Pam 738-750.

ORGANIZATIONAL TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. No audio/noise heard in speaker of amplifier-converter. Check RT **VOLUME** control S9/R1 to see if it is turned off or turned down. If it is turned off, turn it on. If it is just turned down, turn up the **VOLUME** to a comfortable level. Check circuit breaker **PA CB** to see if it is turned off. If it is turned off, turn it on. Check to see if the input power cable is properly connected to the **PA DC PWR** jack **J3,** damaged, or missing. If not connected, connect it. If damaged, replace it. If missing, replace it.

ORGANIZATIONAL TROUBLESHOOTING (CONTINUED)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Check input power source. For vehicle mounted systems, check vehicle battery power. For general purpose type system installation, check dc power supply or temporary battery setup. If power is available, replace power amplifier. If replacing PA has no effect, replace receiver-transmitter. If replacing RT has no effect, notify higher maintenance authority.
2. No **SQUELCH**, too much background noise. Turn AMP-CON (amplifier-converter) **SQUELCH** control S2/R1 clockwise until background noise is eliminated. If AMP-CON **SQUELCH** control goes clockwise to **MAX** with no effect, replace amplifier-converter. If replacing amplifier-converter has no effect, notify higher maintenance authority.
3. No noise of bandswitching heard in PA when changing RT **FREQUENCY** control. Check interconnect cable between **PA** jack **RT CONT J2** and AC jack J5 to see if it is properly connected, damaged, or missing. If cable is disconnected, reconnect it. If cable is damaged, replace it. If cable is missing, replace it. Check interconnect cable between AMP-CON jack J6 and RT jack J1 to see if it is properly connected, damaged, or missing. If cable is disconnected, reconnect it. If cable is damaged, replace it. If cable is missing, replace it. Replace power amplifier and recheck bandswitching. If no bandswitching detected, replace amplifier-converter.

ORGANIZATIONAL TROUBLESHOOTING (CONTINUED)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Recheck bandswitching.
· If no bandswitching is detected, replace receiver-transmitter.
If no bandswitching is detected after replacing receiver-transmitter, notify higher maintenance authority.
4. No beeping noise heard in headset earpiece, but it is heard in the amplifier-converter speaker.
· Replace headset and recheck for beeping noise.
If replacing headset has no effect, replace amplifier-converter.
5. No beeping noise heard in amplifier-converter speaker, but it is heard in the headset earpiece.
Replace amplifier-converter.
6. When the frequency is changed on the receiver-transmitter and the RT is keyed, the (YELLOW) **TUN** lamp, on the PA, should come on. After 60 seconds, the (GREEN) **RDY** lamp should come on. No other PA lamps should come on, except an intermittant lighting of the (RED) **FAULT** lamp may occur during this period. If this sequence does not occur:
Check to see if the receiver-transmitter has power. Press the RT **LIGHT** pushbutton switch S10.
If the RT **FREQUENCY** display light does not come on, go to next test.
Check interconnect cable between PA jack J2 and AMP-CON jack J5 to see if it is properly connected, damaged, or missing.
If cable is disconnected, reconnect it.
If cable is damaged, replace it.
If cable is missing, replace it.
Check interconnect cable between AMP-CON jack J6 and RT jack J1 to see if it is properly connected, damaged, or missing.
If cable is disconnected, reconnect it.
If cable is damaged, replace it.

ORGANIZATIONAL TROUBLESHOOTING (CONTINUED)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
If cable is missing, replace it.
Press **PA FAN/LAMP TEST** switch S1.
All six PA indicators should come on and both PA and CU fans should be heard. If not, go to next test.
Replace power amplifier and recheck receiver-transmitter for power (see first test).
If no RT power is detected, replace amplifier-converter.
Recheck receiver-transmitter for power (see first test).
If no RT power is detected, replace receiver-transmitter and recheck RT for power.
If no RT power is detected after replacing Receiver-Transmitter, notify higher maintenance authority.
7. No power at receiver-transmitter.
Check for overvoltage problem (over 32 volts).
If overvoltage is indicated, radio will automatically reset when voltage is reduced to its proper level.
Check for low voltage problem (below 20 volts).
If low voltage is indicated, radio will automatically reset when voltage is raised to its proper level.
8. **PA TUN** lamp was on for sixty seconds, **RDY** lamp failed to light.
Replace power amplifier and recheck tuning.
If **RDY** lamp fails to light, notify higher level of maintenance.
9. Audible beeping does not stop when **PA RDY** lamp lights.
Replace power amplifier and recheck.

ORGANIZATIONAL TROUBLESHOOTING (CONTINUED)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Replace power amplifier
10. A steady tune signal is not heard in the handset earpiece and the AMP-C ON speaker when the **PTT** switch is momentarily pressed..
Replace handset and repeat 10.
Tune signal still not heard in amplifier-converter speaker, replace amplifier-converter.
11. The **PA RDY** and **TUN** lamps do not remain on and the green PA **XMT** lamp does not come on, after momentarily pressing the **PTT** switch.
Check interconnect cables to see if they are properly connected, damaged, or missing.
If cable is disconnected, reconnect it.
If cable is damaged, replace it.
If cable is missing, replace it.
Faulty power amplifier.
Replace power amplifier.
12. The tuning motors in the CU and PA units cannot be heard for a few seconds, after momentarily pressing the **PTT** switch.
Check interconnect cables to see if they are properly connected, damaged, or missing.
If cable is disconnected, reconnect it.
If cable is damaged, replace it.
If cable is missing, replace it.
Faulty power amplifier.
Replace power amplifier
Faulty antenna coupler.
Replace antenna coupler.

ORGANIZATIONAL TROUBLESHOOTING (CONTINUED)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
13. After about five seconds the **PA TUN** and **XMT** lamps do not go out, leaving just the **PA RDY** lamp on.
Check interconnect cables to see if they are properly connected, damaged, or missing.
If cable is disconnected, reconnect it.
If cable is damaged, replace it.
If cable is missing, replace it.
Faulty power amplifier.
Replace power amplifier
14. The AMP-CON speaker does not mute (no noise should be heard) when **PTT** switch is pressed and held.
Check interconnect cables to see if they are properly connected, damaged, or missing.
If cable is disconnected, reconnect it.
If cable is damaged, replace it.
If cable is missing, replace it.
Faulty amplifier-converter.
Replace amplifier-converter.
15. The PA green **XMT** lamp does not light, when **PTT** switch is pressed and held.
Check interconnect cables to see if they are properly connected, damaged, or missing.
If cable is disconnected, reconnect it.
If cable is damaged, replace it.
If cable is missing, replace it.
Faulty power amplifier.
Replace power amplifier.

ORGANIZATIONAL TROUBLESHOOTING (CONTINUED)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
16. The high voltage power supply in the PA does not make the audible (high pitch) noise it should.
Faulty power amplifier.
Replace power amplifier.
17. When speaking into the mouthpiece, the PA meter does not deflect and/or a sidetone is not heard in the headset earpiece.
Faulty handset.
Replace handset.
Faulty headset.
Replace headset.
Check interconnect cables to see if they are properly connected, damaged, or missing.
If cable is disconnected, reconnect it.
If cable is damaged, replace it.
If cable is missing, replace it.
Faulty power amplifier.
Replace power amplifier.
18. Power Amplifier **FIL FAULT** lamp is lit.
Operation at reduced power is still possible.
Replace power amplifier as soon as possible.

ORGANIZATIONAL TROUBLESHOOTING (CONTINUED)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
19. During tuning, PA bandswitch rotates (searches) continuously and will not stop. Faulty power amplifier. Replace power amplifier.
20. The entire Radio Set shuts down for no apparent reason during normal operation. An overtemperature condition may exist. Check louvers at the input and output cooling ports of the PA and CU. Remove any obstacles. Unit will automatically reset when it reaches the proper temperature. It will be necessary to go through the warmup and tuning again.

Section IV ORGANIZATIONAL MAINTENANCE PROCEDURES

Subject	Para	Page
General	4-6	4-11
Handset Replacement	4-7	4-12
Receiver-Transmitter RT-1209/URC Replacement	4-8	4-12
Amplifier-Converter AM-6879/URC Replacement	4-9	4-12
Power Amplifier AM-6545A/GRC-193A Replacement	4-10	4-13
Antenna Coupler CU-2064/GRC-193A Replacement	4-11	4-13
RT-AC Control Cable Replacement (RTJ1 TO ACJ6)	4-12	4-14
RT-AC Audio Cable Replacement (RTA2J2 TO ACJ2)	4-13	4-14
AC-PA Control Cable Replacement (ACJ5 TO PAJ2)	4-14	4-15
AC-PA RF Coaxial Cable Replacement (ACJ2 TO PAJ5)	4-15	4-15
PA-CU Control Cable Replacement (PAJ1 TO CUJ2)	4-16	4-16
PA-CU RF Coaxial Cable Replacement (PAJ4 TO CUJ1)	4-17	4-16
PA Input Power Cable Replacement (PAJ3 To Power Source)	4-18	4-17

4-6. GENERAL.

This section provides instructions for organizational maintenance of Radio Set AN/GRC-193A. The following initial setup information applies to all procedures.

Resources required are not listed unless they apply only to a particular procedure. Tool Kit, Electronic Equipment TK-101/G is needed for all procedures. Tools will not be listed unless they are not contained

in this kit. All tasks can be performed by one technician. The normal standard equipment condition is power off. Equipment condition will not be listed unless some other condition is required.

Replacement consists of REMOVAL of old equipment and INSTALLATION of new equipment.

NOTE

Always keep in mind the warnings and cautions when doing maintenance procedures.

4-7. HANDSET REPLACEMENT.

REMOVAL

1. Grasp the cable connector of Handset H-250/U firmly and twist clockwise, then pull to loosen and remove the handset from jack A2J1 of Receiver-Transmitter RT-1209/URC.

INSTALLATION

1. Align the connector guide pin of the new handset cable connector to match the guide pin of receiver-transmitter jack A2J1, push the connector firmly and twist the connector counterclockwise to lock it in place.

4-8. RECEIVER-TRANSMITTER RT-1209/URC REPLACEMENT.

REMOVAL

1. Disconnect and remove Handset H-250/U from RT jack A2J1.
2. Disconnect and remove RT-AC control cable 755017A1810 from RT jack J1.
3. Disconnect and remove RT-AC audio cable 755017A1811 from RT jack A2J2.
4. Loosen the two wingnuts that secure the mounting clamps to the front of the RT and remove the mounting clamps and wingnuts. Save the mounting clamps and wingnuts for reinstallation of RT.
5. Carefully remove the receiver-transmitter from the mounting base.

INSTALLATION

1. Align the receiver-transmitter on the mounting base so that the RT is firmly held in place at the rear by the flange on the mounting base.
2. Place the mounting clamps over the mounting bolts so that the front of the RT is held underneath the mounting clamps.
3. Screw the two wingnuts onto the mounting bolts, finger tight.
4. Connect RT-AC audio cable 755017A1811 to RT jack A2J2.
5. Connect RT-AC control cable 755017A1810 to RT jack J1.
6. Connect Handset H-250/U to RT jack A2J1.

4-9. AMPLIFIER-CONVERTER AM-6879/URC REPLACEMENT.

REMOVAL

1. Disconnect and remove Handset H-250/U, headset, CW key, or the data input, if any are connected from AC jack J1.
2. Diconnect and remove RT-AT control cable from AC jack J6.
3. Disconnect and remove RT-AC audio cable from AC jack J2.

4. Disconnect and remove AC-PA control cable from AC jack J5.
5. Disconnect and remove AC-PA RF coaxial cable from AC jack J2.
6. Loosen the two wingnuts that secure the mounting clamps to the front of the AC and remove the mounting clamps and wingnuts. Save the mounting clamps and wingnuts for reinstallation of AC.
7. Carefully remove the amplifier-converter from the mounting base.

INSTALLATION

1. Align the amplifier-converter on the mounting base so that the AC is firmly held in place at the rear by the flange on the mounting base.
2. Place the mounting clamps over the mounting bolts so that the front of the AC is held underneath the mounting clamps.
3. Screw the two wingnuts onto the mounting bolts, finger tight.
4. Connect RT-AC audio cable to AC jack J2.
5. Connect AC-PA control cable to AC jack J5.
6. Connect AC-PA RF coaxial cable to AC jack J2.
7. Connect RT-AC control cable to AC jack J6.
8. Connect any removed Handset H-250/U, headset, CW key, or the data input, if any, to J1.

4-10. POWER AMPLIFIER AM-6545A/GRC-193A REPLACEMENT.

REMOVAL

1. Disconnect and remove AC-PA control cable from PA jack J2.
2. Disconnect and remove AC-PA RF coaxial cable from PA jack J5.
3. Disconnect and remove PA-CU control cable from PA jack J1.
4. Disconnect and remove PA-CU RF coaxial cable from PA jack J4.
5. Disconnect and remove PA-POWER SOURCE cable from PA jack A1J3.
6. Loosen the two wingbolts that secure the mounting clamps to the left side of the power amplifier as seen from the front. Save the mounting clamps and wingbolts for reinstallation of PA.
7. Carefully remove the power amplifier from the mounting base.

INSTALLATION

1. Align the power amplifier on the mounting base so that the PA is firmly held in place by the block wedges on the mounting base and the mounting clamps.
2. Place the wingbolts through the mounting clamps and screw the wingbolts into the mounting base, finger tight.
3. Connect PA-POWER SOURCE cable to PA jack A1J3.
4. Connect PA-CU RF coaxial cable to PA jack J4.
5. Connect PA-CU control cable to PA jack J1.
6. Connect AC-PA RF coaxial cable to PA jack J5.
7. Connect AC-PA control cable to PA jack J2.

4-11. ANTENNA COUPLER CU-2064/GRC-193A REPLACEMENT.

REMOVAL

1. Disconnect and remove PA-CU control cable from CU jack J2.
2. Disconnect and Remove PA-CU RF coaxial cable from CU jack J1.

3. Disconnect and remove CU-50 OHM ANTENNA cable from CU jack J3, if this is the type of antenna being used.
4. Disconnect and remove CU-TO WHIP ANTENNA cable from CU jack J4, if this is the type of antenna being used.
6. Loosen the two wingbolts that secure the mounting clamps to the right side of the Antenna Coupler as seen from the front. Save the mounting clamps and wingholts for reinstallation of CU.
7. Carefully remove the antenna coupler from the mounting base.

INSTALLATION

1. Align the antenna coupler on the mounting base so that the CU is firmly held in place by the block wedges on the mounting base and the mounting clamps.
2. Place the wingbolts through the mounting clamps and screw the wingbolts into the mounting base, finger tight.
3. Connect CU-TO WHIP ANTENNA cable to CU jack J4, if this is the type of antenna being used.
4. Connect CU-50 OHM ANTENNA cable to CU jack J3, if this is the type of antenna being used.
5. Connect PA-CU RF coaxial cable to CU jack J1.
6. Connect PA-CU control cable to Cu jack J2.

4-12. RT-AC CONTROL CABLE REPLACEMENT (RTJ1 TO ACJ6).

REMOVAL

1. Remove Handset (see paragraph 4-7).
2. Remove receiver-transmitter (see paragraph 4-8).
3. Remove amplifier-converter (see paragraph 4-9).
4. Remove power amplifier (see paragraph 4-10).
5. Remove antenna coupler (see paragraph 4-11).
6. Loosen and remove the No. 8 nuts, flatwashers, and lockwashers that secure the cable clamps and cable to the mounting base.
7. Carefully remove the RT-AC control cable from the mounting base.

INSTALLATION

1. Carefully install the RT-AC control cable onto the mounting base so that the cable is located under the cable clamps.
2. Secure the No. 8 nuts, flatwashers, and lockwashers that hold the cable clamps and cable to the mounting base.
3. Install antenna coupler (see paragraph 4-11).
4. Install power amplifier (see paragraph 4-10).
5. Install amplifier-converter (see paragraph 4-9).
6. Install receiver-transmitter (see paragraph 4-8).
7. Install handset (see paragraph 4-7).

4-13. RT-AC AUDIO CABLE REPLACEMENT (RTA2J2 TO ACJ2).

REMOVAL

1. Remove handset (see paragraph 4-7).
2. Remove receiver-transmitter (see paragraph 4-8).

3. Remove amplifier-converter (see paragraph 4-9).
4. Remove power amplifier (see paragraph 4-10).
5. Remove antenna coupler (see paragraph 4-11).
6. Loosen and remove the No. 8 nuts, flatwashers, and lockwashers that secure the cable clamps and cable to the mounting base.
7. Carefully remove the RT-AC audio cable from the mounting base.

INSTALLATION

1. Carefully install the RT-AC audio cable onto the mounting base so that the cable is located under the cable clamps.
2. Secure the No. 8 nuts, flatwashers, and lockwashers that hold the cable clamps and cable to the mounting base.
3. Install antenna coupler (see paragraph 4-11).
4. Install power amplifier (see paragraph 4-10).
5. Install amplifier-converter (see paragraph 4-9).
6. Install receiver-transmitter (see paragraph 4-8).
7. Install handset (see paragraph 4-7).

4-14. AC-PA CONTROL CABLE REPLACEMENT (ACJ5 TO PAJ2).

REMOVAL

1. Remove handset (see paragraph 4-7).
2. Remove receiver-transmitter (see paragraph 4-8).
3. Remove amplifier-converter (see paragraph 4-9).
4. Remove power amplifier (see paragraph 4-10).
5. Remove antenna coupler (see paragraph 4-11).
6. Loosen and remove the No. 8 nuts, flatwashers, and lockwashers that secure the cable clamps and cable to the mounting base.
7. Carefully remove the AC-PA control cable from the mounting base.

INSTALLATION

1. Carefully install the AC-PA control cable onto the mounting base so that the cable is located under the cable clamps.
2. Secure the No. 8 nuts, flatwashers, and lockwashers that hold the cable clamps and cable to the mounting base.
3. Install antenna coupler (see paragraph 4-11).
4. Install power amplifier (see paragraph 4-10).
5. Install amplifier-converter (see paragraph 4-9).
6. Install receiver-transmitter (see paragraph 4-8).
7. Install handset (see paragraph 4-7).

4-15. AC-PA RF COAXIAL CABLE REPLACEMENT (ACJ2 TO PAJ5).

REMOVAL

1. Remove handset (see paragraph 4-7).
2. Remove receiver-transmitter (see paragraph 4-8).
3. Remove amplifier-converter (see paragraph 4-9).
4. Remove power amplifier (see paragraph 4-10).
5. Remove antenna coupler (see paragraph 4-11).

6. Loosen and remove the No. 8 nuts, flatwashers, and lockwashers that secure the cable clamps and cable to the mounting base.
7. Carefully remove the AC-PA RF coaxial cable from the mounting base.

INSTALLATION

1. Carefully install the AC-PA RF coaxial cable onto the mounting base so that the cable is located under the cable clamps.
2. Secure the No. 8 nuts, flatwashers, and lockwashers that hold the cable clamps and cable to the mounting base.
3. Install antenna coupler (see paragraph 4-11).
4. Install power amplifier (see paragraph 4-10).
5. Install amplifier-converter (see paragraph 4-9).
6. Install receiver-transmitter (see paragraph 4-8).
7. Install handset (see paragraph 4-7).

4-16. PA-CU CONTROL CABLE REPLACEMENT (PAJ1 TO CUJ2).

REMOVAL

1. Remove handset (see paragraph 4-7).
2. Remove receiver-transmitter (see paragraph 4-8).
3. Remove amplifier-converter (see paragraph 4-9)M.
4. Remove power amplifier (see paragraph 4-10).
5. Remove antenna coupler (see paragraph 4-11).
6. Loosen and remove the No. 8 nuts, flatwashers, and lockwashers that secure the cable clamps and cable to the mounting base.
7. Carefully remove the PA-CU control cable from the mounting base.

INSTALLATION

1. Carefully install the PA-CU control cable onto the mounting base so that the cable is located under the cable clamps.
2. Secure the No. 8 nuts, flatwashers, and lockwashers that hold the cable clamps and cable to the mounting base.
3. Install antenna coupler (see paragraph 4-11).
4. Install power amplifier (see paragraph 4-10).
5. Install amplifier-converter (see paragraph 4-9).
6. Install receiver-transmitter (see paragraph 4-8).
7. Install handset (see paragraph 4-7).

4-17. PA-CU RF COAXIAL CABLE REPLACEMENT (PAJ4 TO CUJ1).

REMOVAL

1. Remove handset (see paragraph 4-7).
2. Remove receiver-transmitter (see paragraph 4-8).
3. Remove amplifier-converter (see paragraph 4-9).
4. Remove power amplifier (see paragraph 4-10).
5. Remove antenna coupler (see paragraph 4-11).
6. Loosen and remove the No. 8 nuts, flatwashers, and lockwashers that secure the cable clamps and cable to the mounting base.
7. Carefully remove the PA-CU RF coaxial cable from the mounting base.

INSTALLATION

1. Carefully install the PA-CU RF coaxial cable onto the mounting base so that the cable is located under the cable clamps.
2. Secure the No. 8 nuts, flatwashers, and lockwashers that hold the cable clamps and cable to the mounting base.
3. Install antenna coupler (see paragraph 4-11).
4. Install power amplifier (see paragraph 4-10).
5. Install amplifier-converter (see paragraph 4-9).
6. Install receiver-transmitter (see paragraph 4-8).
7. Install handset (see paragraph 4-7).

4-18. PA INPUT POWER CABLE REPLACEMENT (PAJ3 TO POWER SOURCE).

REMOVAL

1. Remove handset (see paragraph 4-7).
2. Remove receiver-transmitter (see paragraph 4-8).
3. Remove amplifier-converter (see paragraph 4-9).
4. Remove power amplifier (see paragraph 4.10).
5. Remove antenna coupler (see paragraph 4.11).
6. Loosen and remove the No. 8 nuts, flatwashers, and lockwashers that secure the cable clamps and cable to the mounting base.
7. Carefully remove the PA-INPUT POWER cable from the mounting base.

INSTALLATION

1. Carefully install the PA-INPUT POWER cable onto the mounting base so that the cable is located under the cable clamps.
2. Secure the No. 8 nuts, flatwashers, and lockwashers that hold the cable clamps and cable to the mounting base.
3. Install antenna coupler (see paragraph 4-11).
4. Install power amplifier (see paragraph 4-10).
5. Install amplifier-converter (see paragraph 4-9).
6. Install receiver-transmitter (see paragraph 4-8).
7. Install handset (see paragraph 4-7).

CHAPTER 5

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Subject	Section	Page
Repair Parts; Special Tools; Test, Measurement and Diagnostic Equipment (TMDE); and Support Equipment	I	5-1
Direct Support Maintenance Procedures	II	5-2

Section I REPAIR PARTS; SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

Subject	Para	Page
Common Tools and Equipment	5-1	5-1
Special Tools and Equipment	5-2	5-1
Repair Parts	5-3	5-1

5-1. COMMON TOOLS AND EQUIPMENT.

The following is a complete listing of common tools and aquipment used during direct support maintenance functions. Another list is given in the Maintenance Allocation Chart (MAC) in appendix B at the back of this manual.

DIRECT SUPPORT MAINTENANCE TOOL LIST

NOMENCLATURE	NSN
TOOL KIT, ELECTRONIC EQUIPMENT, TK-105/G	5180-00-610-8177
MULTIMETER, DIGITAL AN/PSM-45	6625-01-139-2512

5-2. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.

Refer to **TM 11-5820-924-24P** for special tools, TMDE, and support equipment used during direct support maintenance functions.

5-3. REPAIR PARTS.

Repair parts for direct support maintenance of the AN/GRC-193A Radio Set are listed and illustrated in the following direct support maintenance procedures.

Section II DIRECT SUPPORT MAINTENANCE PROCEDURES

Subject	Para	Page
General	5-4	5-2
Repair of Control Cable Assembly (PA-CU)	5-5	5-2
Repair of RF Coaxial Cable Assembly (PA-CU)	5-6	5-9

5-4. GENERAL.

This chapter covers the repair of components authorized at the direct support level of maintenance. The normal equipment condition to start a maintenance task is power off. All tasks at the direct support level can be done by one technician.

NOTE

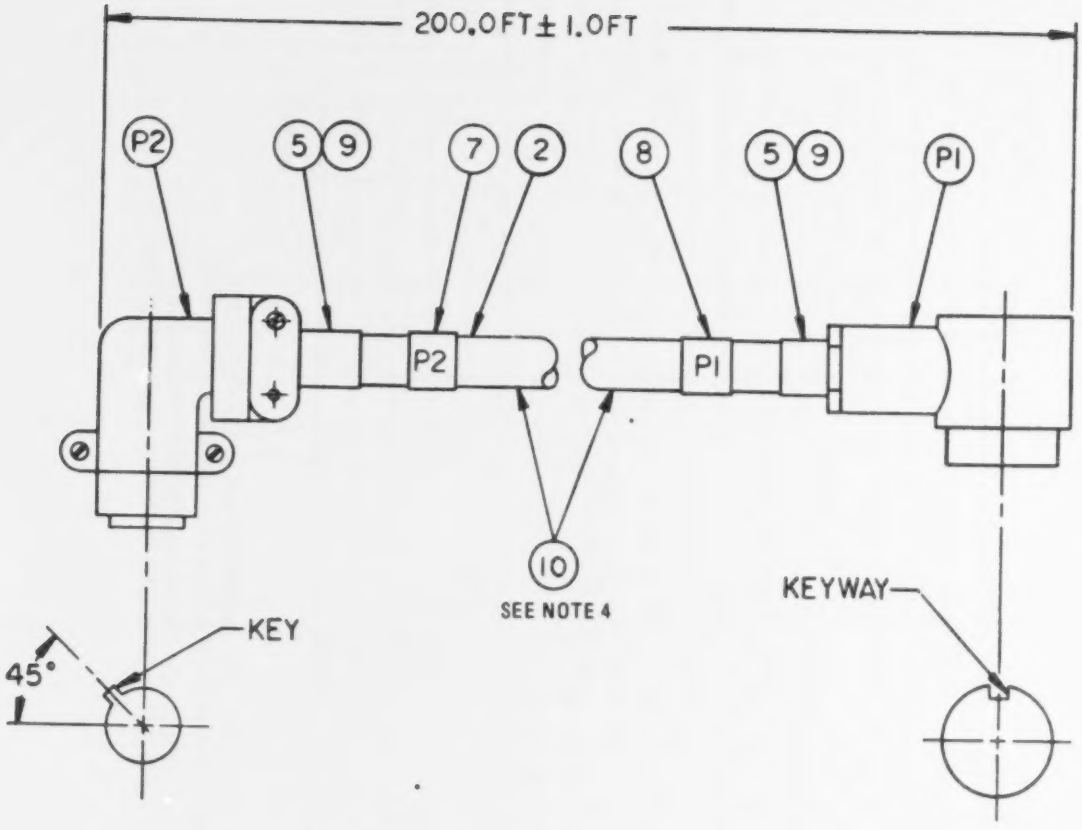
Always keep in mind the warnings and cautions when doing routine maintenance procedures.

Cable maintenance is divided into two steps: troubleshooting and repair. Troubleshooting locates the cable defect to be repaired. The repair step corrects the defect. Possible defects to look out for are open conductors, cable conductors that are shorted together, broken or misaligned connector pins, and broken or cracked connector shells. Except for the shorted or open conductors, all other defects are found by close visual inspection of the cable assembly. The shorted or open conductors must be located using the AN/PSM-45 Multimeter.

Repair damaged cable component by replacement of like component from the list of parts, using the cable assembly illustrations and wiring diagram as a guide.

5-5. REPAIR OF CONTROL CABLE ASSEMBLY 75501780110.

TOOLS: TK-105/G Tool Kit, Electronic Equipment
AN/PSM-45 Digital Multimeter
Heat, Gun, Electric *HG 301U, 7290-00-977-9957
Crimp Tool, Buchanan #33366
Insertion Tool #MS 24256A20
Extraction Tool #MS 24256R16



NOTES:

1. STRIP WHITE/GREEN, YELLOW AND WHITE/BLUE WIRES AND SOLDER. APPLY SHRINK SLEEVING (ITEM 9) OVER EACH JUNCTION AT BOTH ENDS.
2. STRIP WHITE/YELLOW, BLACK AND WHITE/VIOLET WIRES AND SOLDER. APPLY SHRINK SLEEVING (ITEM 9) OVER EACH JUNCTION AT BOTH ENDS.
3. APPLY SLEEVING (ITEM 9) TO BOTH GND BRAIDS (BOTH ENDS) TO ITEM 2 (CABLE).
4. ITEM 10, CABLE MARKERS, ARE TO BE LOCATED 6 INCHES FROM P1 AND P2.

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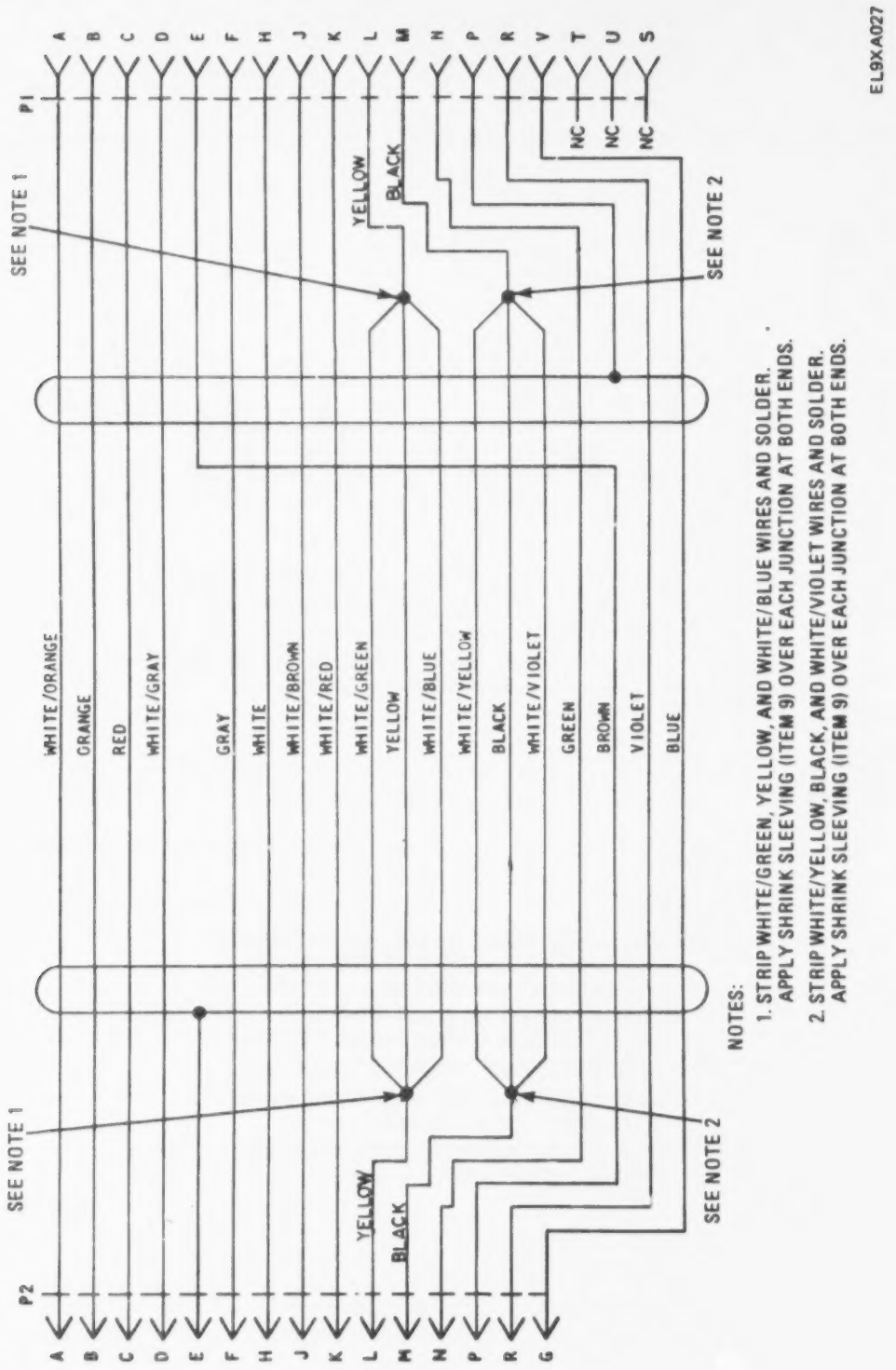

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NOTES:

1. STRIP WHITE/GREEN, YELLOW, AND WHITE/BLUE WIRES AND SOLDER. APPLY SHRINK SLEEVING (ITEM 9) OVER EACH JUNCTION AT BOTH ENDS.
2. STRIP WHITE/YELLOW, BLACK, AND WHITE/VIOLET WIRES AND SOLDER. APPLY SHRINK SLEEVING (ITEM 9) OVER EACH JUNCTION AT BOTH ENDS.

MATERIALS/PARTS:

REPAIR PARTS LIST FOR CONTROL CABLE ASSEMBLY 755017B0110

Item	Description		Part Number	Quantity
P1	Connector, Plug		MW10M(M)D17	1
P2	Connector, Plug		755017A9049	1
2	Cable, Multiconductor		755017A9036	200 ft.
3	Solder, Tin-Lead Alloy	(NOTE 1)	(item 4, appendix E)	A/R
4	Wire, Electrical	(NOTE 2)	755017A3935-10	.416 ft.
5	Shrink Sleeving	(NOTE 2)	755017A4048-3	4.5 in.
6	Sealant	(NOTE 1)	755017A8360	1 Tube
7	Marker, Cable, P2		755017B0798-20	1
8	Marker, Cable, P1		755017B0798-19	1
9	Shrink Sleeving	(NOTE 2)	755017A3945-14	.5 in.
10	Marker, Cable, Identification		755017B0798-1	2
11	Wire, 22 AWG, White	(NOTE 2)	MIL-W-16878/1	6.75 in.

NOTES:
1. Expendable item.
2. Bulk supply item.

REPAIR

The following is a complete assembly instruction for the 755017B0110 control cable assembly. If complete refurbishment is not required, use only that part of the instruction necessary to complete the repair of the cable assembly.

1. Cut cable, sleeving, and wire to lengths listed below:

QTY	ITEM	MATERIAL	LENGTH
1	2	Cable	200.00 FT.
1	5	Shrink Sleeve	2.5 INCHES
6	9	Shrink Sleeve	0.5 INCHES
1	5	Shrink Sleeve	2.0 INCHES
3	11	Wire, 22 AWG, White	2.25 INCHES

2. Cut wires and prepare cable using the following instructions:

   a. At both ends of the cable, remove outer jacket of cable (item 2) so that wires are exposed 1 3/4 inches. Place a Ty-rap about 1/4 of an inch from the end of the outer jacket, on both ends to hold the conductors together.
   b. Comb out the braid on both ends of the cable. Divide the braid into four equal parts and cut off three of those parts. NOTE: Cut protective plastic to 1/4 inch from end of outer jacket. Twist and tin the remaining part and cut it to a 3/8-inch length, on both ends.
   c. Attach pre-cut wires (item 11) to tinned end of braids by twisting together and soldering. Slide shrink sleeving (item 9) over wire (item 11) and braid and shrink with heat gun.
   d. Strip the white/green, yellow, and white/blue wires, on both ends of the cable, 1 inch. Twist the three leads together such that the yellow lead is left sticking out to be soldered to the connector. Apply shrink sleeving (item 9) over each junction.

e. Strip the white/yellow, black, and white/violet wires, on both ends of the cable, 1 inch. Twist the three leads together such that the black lead is left sticking out to be soldered to the connector. Apply shrink sleeving (item 9) over each junction.

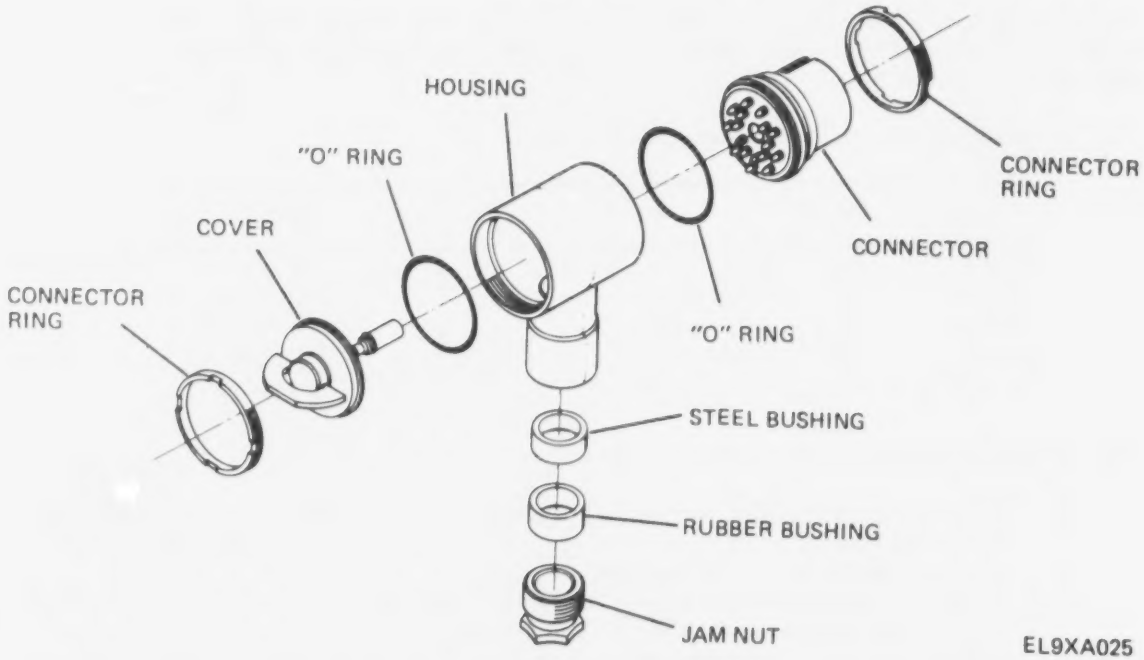
f. Cut the white/black wire flush to the outer jacket on both ends of the cable.

g. On both ends of the cable (item 2), strip 3/16 of an inch of insulation from the twelve remaining conductors in the cable. Twist and tin all twelve leads.

3. Assemble connector P1 using the following procedure:

a. Locate P1 connector and check parts against the following list:

PART DESCRIPTION	QUANTITY
Housing	1
Connector	1
Steel Bushing	1
Rubber Bushing	1
Jam Nut	1
"O" Rings	2
Connector Rings	2
Cover	1



b. Cut-off ty-wrap at the end of cable (item 2) that has prepared conductors. Slide the jam nut onto the cable with the threads towards the end of the cable. Position the rubber bushing and the steel bushing next to the jam nut.

c. Position black shrink sleeving (item 5) over end of cable 1/8 of an inch beyond outer jacket, so that no braid shows. Shrink in place.
d. Insert cable (item 2) through connector HOUSING and slide down cable feeding the cable through the CONNECTOR.
e. Pre-fill all connector cups with solder (item 3), except cups S, T, and U.
f. Position cable with connector HOUSING and CONNECTOR making sure that keyway is on the bottom when facing the end of the CONNECTOR.
g. Terminate all leads per wire chart, dressing and cutting leads to length.

CONTROL CABLE CONNECTOR P1 WIRING CHART

COLOR	PIN	COLOR	PIN	COLOR	PIN
White	H	Violet	R	Yellow	L
Wht/Brn	J	Shield	P	Black	M
Gray	F	Red	C	Wht/Orn	A
Brn	E	Blue	V	Green	N
Wht/Gry	D	Wht/Red	K	Orange	B

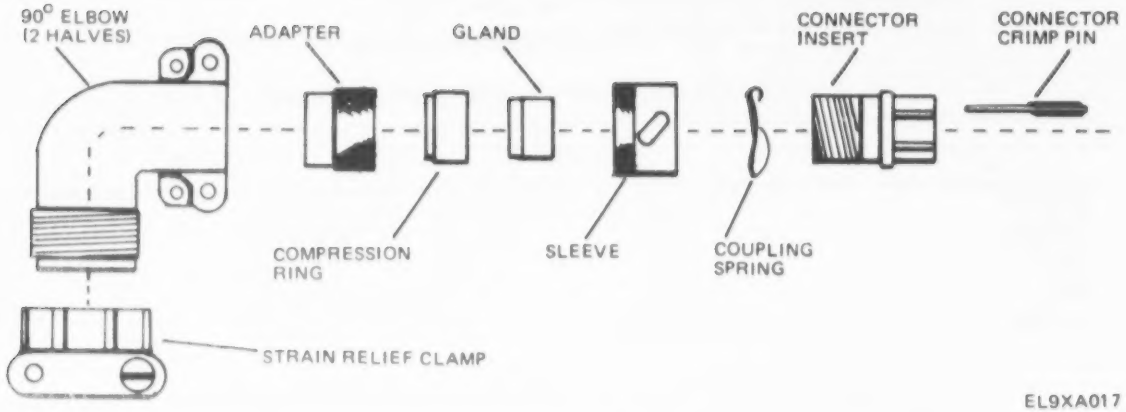
h. Push cable back through housing, until the outer jacket of cable is flush with the inside opening of the connector fixture.
i. Secure the cable in place with connector ring. Place "O" ring in slot provided in bottom of housing, before connector is placed into housing.
j. Push shrink sleeving into housing, until 1/2 inch is outside housing, and shrink with a heat gun.
k. Push remaining connector parts (jam nut, metal bushing, and rubber bushing) into housing and tighten with a 3/4 inch open end wrench. NOTE: Cable jacket must be visible in the inside of the connector opening.

4. Before installing the P2 connector, install the P2 cable marker (item 7), the cable identification marker (item 10), and the P1 cable marker (item 8) on the cable as shown in the assembly drawing. Do not shrink in place.

5. Assemble connector P2 using the following procedure:

a. Locate P2 connector and check parts against the following list:

PART DESCRIPTION	QUANTITY
Connector Crimp Pins	15
Connector Insert	1
Coupling Spring	1
Sleeve	1
Gland	1
Compression Ring	1
Adapter	1
90° Shell Halves	2
Strain Relief Clamp	1
Screw	4
Lockwasher	4



b. Insert the stripped wires of the control cable through the strain Relief Clamp, ADAPTER, COMPRESSION RING, SLEEVE, and COUPLING SPRING. NOTE: The GLAND is attached to the CONNECTOR INSERT with sealant (item 6) so that all of the pin holes are lined up properly.

c. Install CONNECTOR CRIMP PINS onto each wire shown on the Control Cable P2 Connector Wiring Chart, using a #33366 Buchanan crimping tool.

d. Terminate wires by pressing the pins through the GLAND into the CONNECTOR INSERT, using a # MS24256A20 Insertion tool. Extractor # MS24256R16 is used to remove the pins from the CONNECTOR INSERT.

CONTROL CABLE CONNECTOR P1 WIRING CHART

COLOR	PIN	COLOR	PIN	COLOR	PIN
Wht/Orn	A	Shield	E	Wht/Red	K
Orange	B	Black	M	Wht/Brn	J
Red	C	Brown	P	White	H
Wht/Gry	D	Violet	R	Blue	G
Green	N	Yellow	L	Gray	F

6. Position marker (item 8) 1/2 inch from P1 connector and shrink with heat gun.

7. Slide sleeving (item 9) into place at P2 connector end of cable, so that the end of the sleeve is even with the outer jacket of the cable and shrink with heat gun.

8. Slide the Compression ring down over the wires and seat it firmly on the rubber gland.

9. Slide the adapter down over the wires and screw it onto the threaded end of the connector insert behind the sleeve and coupling ring.

10. Assemble elbow halves so that the lip on the elbows (the end with the screws) fits over the end of the adapter toward the front of the connector. Fasten the two elbow halves together with the screws and lockwashers provided.

11. Screw strain relief clamp onto bottom of elbow halves and secure to the cable using screws and lockwashers provided.

12. Position marker (item 7) 1/2 inch from shrink sleeving (item 9) and shrink with heat gun.

13. Position marker (item 10) at the midpoint of the cable and shrink with heat gun.

5-6. REPAIR OF RF COAXIAL CABLE ASSEMBLY 755017B0140.

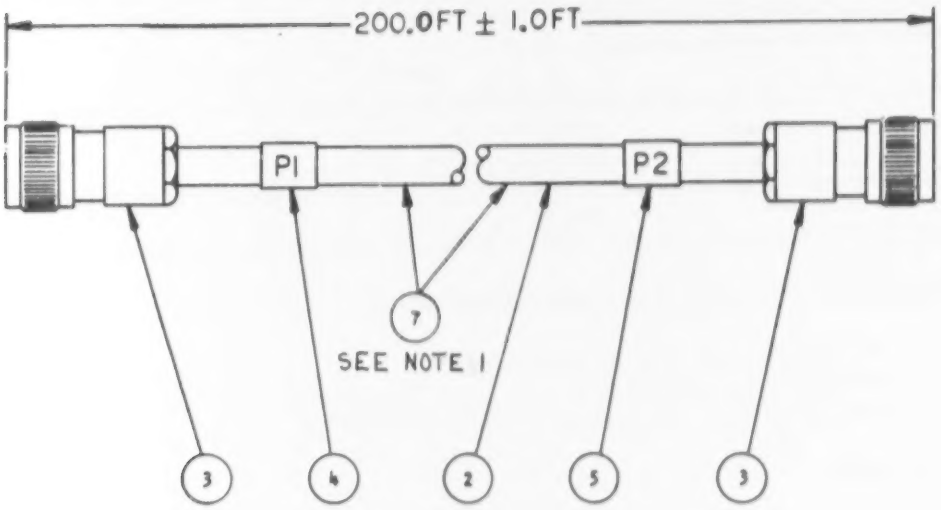
TOOLS: TK-105/G Tool Kit, Electronic Equipment
AN/PSM-45 Digital Multimeter
Heat, Gun, Electric No. HG 301U, 7290-00-977-9957

MATERIALS/PARTS:

REPAIR PARTS LIST FOR COAXIAL CABLE ASSEMBLY 755017B0140

Item	Description		Part Number	Quantity
2	Cable, Coaxial	(NOTE 2)	RG213/U	200 Ft.
3	Connector, Type "N"		UG21D/U	2
4	Marker, Cable		755017B0798-19	1
5	Marker, Cable		755017B0798-20	1
6	Solder, Tin-Lead Alloy	(NOTE 1)	item 4 Appendix E	A/R
7	Marker, Cable		755017AB0798-2	2

NOTES: 1. Expendable item.
2. Bulk supply item.



NOTES:

1. ITEM 7, CABLE MARKERS, ARE TO BE LOCATED 6 INCHES FROM P1 AND P2.

EL9XA028

REPAIR:

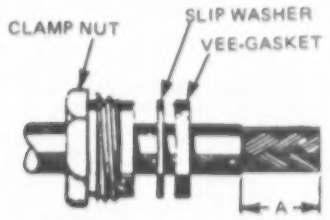
The following is a complete assembly instruction for the 7550178O140 coaxial cable assembly. If complete refurbishment is not required, use only that part of the instruction necessary to complete the repair of the cable assembly.

1. Condition both ends of coaxial cable (item 2) V per following trim chart.

TRIM CODE CHART

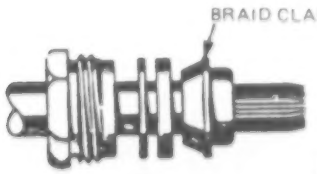
CODE	A	B	C
1014	7/16	1/8	5/32

2. Cut cable end square, place clamp-nut, slip washer (when supplied), and gasket over jacket. Remove jacket to dimension "A"



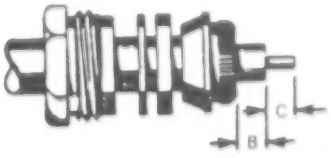
EL9XA018

3. Comb out braid and taper forward. Place braid clamp over braid against jacket cut.



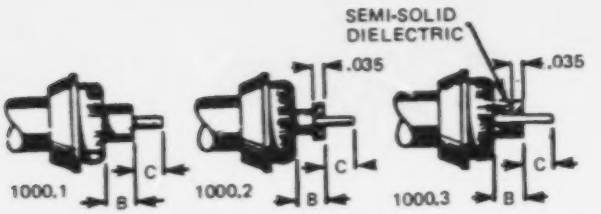
EL9XA019

4. Fold braid back over braid clamp and trim as shown below. Remove dielectric to dimension "B". Cut center conductor to dimension "C".



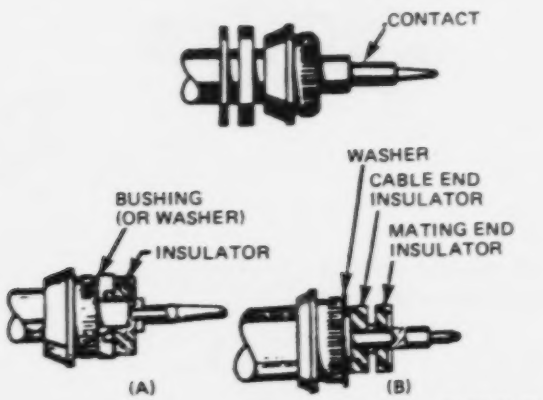
EL9XA020

5. When cable positioning insulators are used, adjust trim code dimensions as shown below, and as assembled as indicated.



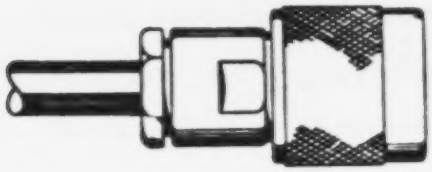
EL9XA021

6. Solder contact to center conductor. For access type angle connector, omit this step and proceed to step 7. For captive contacts: (a) assemble bushing and insulator, attach contact, or (b) assemble washer and larger (cable end) insulator. Attach contact. Assemble smaller (mating end) insulator.



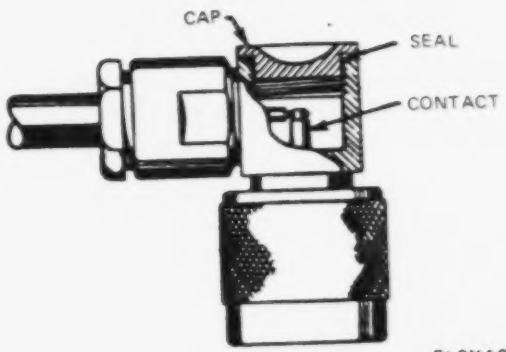
EL9XA022

7. Thread assembly into connector, and lock securely. The gasket must be split by braid clamp.



EL9XA023

8. For access type angle connectors, solder center conductor in contact groove. Close access opening.



EL9XA024

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APPENDIX A

REFERENCES

AR 700-58	Report of Packaging and Handling Deficiencies.
AR 755-2	Disposal of Excess, Surplus, Foreign Excess, Captured, and Unwanted Materiel.
DA Form 2404	Equipment Inspection and Maintenance Worksheet.
DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
DA Pam 738-750	The Army Maintenance Management System (TAMMS).
SB 11-131	Vehicular Radio Sets and Authorized Installation.
SB 38-100	Preservation, Packaging, Packing and Marking Materials, Supplies, and Equipment Used by the Army.
SF 361	Discrepancy in Shipment Report (DISREP).
SF 364	Report of Discrepancy (ROD).
SF 368	Quality Deficiency Report.
TB SIG 291	Safety Measures to be Observed when Installing and Using Whip Antenna, Field-type Masts, Towers, Antennas, and Metal Poles that are Used with Communication, Radar, and Direction Finder Equipment.
TB 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment, Including Camouflage Pattern Painting of Electrical Equipment Shelters.
TM 11-2300-474-13&P	Installation Kit MK-2460/GRC-193A.
TM 11-2300-475-13&P-1	Installation Kit (Wheeled) MK-2462/GRC-193A.
TM 11-2300-475-13&P-2	Installation Kit MK-2459/GRC-193A.
TM 11-2300-475-13&P-3	Installation Kit MK-2461/GRC-193A.
TM 11-2300-475-13&P-4	Installation Kit MK-2458/GRC-193A.
TM 11-5820-924-24P	Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Radio Set AN/GRC-193A.

M 11-6625-203-12	Operator's and Organizational Maintenance Manual: Multimeter AN/URM-105 and AN/URM-105C, including Multimeter ME-77/U and ME-77C/U
M 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command)

APPENDIX B

MAINTENANCE ALLOCATION
RADIO SET AN/GRC-193A

Section I. INTRODUCTION

B-1. GENERAL.

This appendix provides a summary of the maintenance operations for the AN/GRC-193A Radio Set, the maintenance functions that must be performed, and the time, tools, and test equipment necessary to perform the maintenance.

B-2. MAINTENANCE FUNCTION.

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, ie., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, faults, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components.

B-3. COLUMN ENTRIES.

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for the purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "worktime" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "worktime" figures will be shown for each category. The number of task-hours specified by the "worktime" figure represents the average time required to restore an item (assembly, subassembly, component, module, and item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C	Operator/Crew
O	Organizational
F	Direct Support
H	General Support
D	Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets, (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in Section IV, Remarks, which is pertinent to the item opposite the particular code.

B-4. TOOL AND TEST EQUIPMENT REQUIREMENTS (Section III).

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment columns of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

B-5. REMARKS (Section IV).

a. Reference Code. This code refers to the appropriate item in Section II, column 6.

b. Remarks. This column provides the required explanatory information necessary to clarify items appearing in Section II.

Section II. MAINTENANCE ALLOCATION CHART FOR RADIO SET AN/GRC-193A

(1)	(2)	(3)	(4) MAINTENANCE CATEGORY					(5)	(6)
GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	C	O	F	H	D	TOOLS AND TEST EQUIP.	REMARKS
00	RADIO SET AN/GRC-193A	INSPECT		1.0				1	A
		ADJUST		0.2				1,3	B
		TEST		0.5				3	C
		REPAIR		0.5				1	D
		INSTALL		1.0				1	E
		SERVICE	0.1					1	F
		OVERHAUL					10.	1	L
01	R/T 1209/URC RCVR-XMTR	REPLACE		1.0				1	G
02	AM-6879/URC AMPL-CNVRTR	REPLACE		1.0				1	H
03	AM-6545 RF PWR AMPL	TEST				0.5		3,5,15,16,17 ,18	I
		REPLACE		1.0				1	
		REPAIR				1.0		2	I,J
		REPAIR					8.0	4,5,7,11,12 13,16,18,19	K,L
		TEST					8.0	4,5,7,11,12, 13,16,18,19	
0301	1A1 METER PWB ASSY	TEST					1.0	3	K,L
		REPLACE				0.2		2	
		REPAIR					1.0	2	K,L
0302	1A2 DC CONTROL PWB ASSY	TEST					1.0	3,17,18,19	K,L
		ADJUST					1.0	3,18,19	K,L
		REPLACE				0.2		2	
		REPAIR					1.0	2	K,L
0303	1A3 SYSTEM CONTROL PWB ASSY	TEST					1.0	3,18,19	K,L
		ADJUST					1.0	3,18,19	K,L
		REPLACE				0.2		2	
		REPAIR					1.0	2	K,L
0304	1A4 TUNE CONTROL PWB ASSY	TEST					1.0	3	K,L
		REPLACE				0.2		2	
		REPAIR					1.0	2	K,L

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND TEST EQUIP.	(6) REMARKS
0305	1A5 SERVO AMPL PWB ASSY	TEST					1.0	3	K,L
		REPLACE				0.2		2	
		REPAIR					1.0	2	K,L
0306	1A6 BAND CONTROL PWB ASSY	TEST					1.0	3	K,L
		REPLACE				0.2		2	
		REPAIR					1.0	2	K,L
0307	1A7 ALC MODULE	TEST					1.0	3-5,7,16,18, 19	K,L
		REPAIR					1.0	2	K,L
		REPLACE				1.0		2	
030701	1A7A1 TUNE LOAD PWB ASSY	TEST					1.0	3	K,L
		REPAIR					1.0	2	K,L
		REPLACE					1.0	2	
030702	1A7A2 ALC PWB ASSY	TEST					1.0	3	K,L
		ADJUST					1.0	2-5,7,16,18, 19	K,L
		REPLACE					2.0	2	
		REPAIR					1.0	2	K,L
0308	1A8 TANK CIRCUIT ASSY	TEST					1.0	3	K,L
		REPLACE				0.2		2	
		REPAIR					1.0	2	K,L
030801	1A8A1 INPUT CAP PWB ASSY	TEST					1.0	3	K,L
		REPAIR					1.0	2	K,L
		REPLACE					1.0	2	
030802	1A8A2 OUTPUT CAP PWB ASSY	TEST					1.0	3	K,L
		REPAIR					1.0	2	K,L
		REPLACE					1.0	2	
030803	1A8A3 COIL GEAR ASSY	TEST					1.0	3	K,L
		REPAIR					1.0	2	K,L
		REPLACE					1.0	2	
030804	1A8A4 BAND SWITCH GEAR ASSY	TEST					1.0	3	K,L
		REPAIR					1.0	2	K,L
		REPLACE					1.0	2	

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND TEST EQUIP.	(6) REMARKS
030805	1A8A5 COIL ASSY	TEST					1.0	3	K,L
		REPAIR					1.0	2	K,L
		REPLACE					1.0	2	
030806	1A8W1 TANK HARNESS ASSY	TEST					1.0	3	K,L
		REPAIR					1.0	2	K,L
		REPLACE					1.0	2	
0309	1A9 PLATE	TEST					1.0	3	K,L
		REPAIR					2.0	2	K,L
		REPLACE				0.2		2	
0310	1A10 TUNE DETECTOR ASSY	TEST					1.0	3,10,18,19	K,L
		REPLACE				0.2		2	
		ALIGN					2.0	3,10,18,19	K,L
		REPAIR					2.0	2	K,L
031001	1A10A1 TUNE DET PWB ASSY	TEST					1.0	3,10,18,19	K,L
		REPLACE					0.2	2	
		ALIGN					2.0	3,10,18,19	K,L
		REPAIR					2.0	2	K,L
0311	1A11 RF DRIVE MODULE	TEST					2.0	3	K,L
		REPLACE				0.2		2	
		REPAIR					1.0	2	K,L
031101	1A11A1 DRIVER MDL PWB ASSY	TEST					2.0	3	K,L
		REPLACE					0.2	2	
		REPAIR					1.0	2	K,L
0312	1A12 INVERTER MODULE	TEST					1.0	3,14	K,L
		REPLACE				0.2		2	
		REPAIR					1.0	2	K,L
		ADJUST					1.0	2,3,14,18, 19	K,L
031201	1A12A1 INVERTER MODULE PWB ASSY	TEST					1.0	3,14	K,L
		REPLACE					0.2	2	
		REPAIR					1.0	2	K,L
		ADJUST					1.0	2,3,14,18, 19	K,L

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND TEST EQUIP.	(6) REMARKS
0313	1A12 HV MODULE	TEST					1.0	3	K,L
		REPLACE				0.2		2	
		REPAIR					1.0	2	K,L
031301	1A13A1 HV MODULE PWB ASSY	TEST					1.0	3	K,L
		REPLACE					0.2	2	
		REPAIR					1.0	2	K,L
0314	1A14 CASE ASSY	REPAIR					1.0	2	K,L
		REPLACE				0.5		2	
		REPAIR				1.0		2	I,M
		TEST					1.0	3	K,L
031401	1A14A1 INTERCONNECT PWB ASSY	TEST					1.0	3	K,L
		REPAIR					1.0	2	K,L
		REPLACE				2.0		2	
031402	1A14A2 TUBE SOCKET ASSY	TEST					1.0	3	K,L
		REPAIR					1.0	2	K,L
		REPLACE					0.5	2	
031403	1A14A3 DC-DC CONVERTER ASSY	TEST					1.0	3	K,L
		REPAIR					1.0	2	K,L
		REPLACE				1.0		2	
031404	1A14A4 INDICATOR ASSY	TEST					1.0	3	K,L
		REPAIR					1.0	2	K,L
		REPLACE				1.0		2	
0315	1A15 HARMONIC FILTER ASSY	TEST					1.0	3	K,L
		REPAIR					2.0	2	K,L
		REPLACE				1.0		2	
04	CU-2064 ANTENNA COUPLER	TEST				1.0		3,14,16,18, 19	N
		REPLACE		0.1				1	
		REPAIR				1.0		2	J,N
		REPAIR					8.0	5,10,15,16, 18,19	L,O
		TEST					8.0	3,14,16,18, 19	

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND TEST EQUIP.	(6) REMARKS
401	2A1 CASE ASSY	REPAIR					2.0	3	L,O
		REPLACE				0.5		2	
		TEST					1.0	3	L,O
402	2A2 CHASSIS ASSY	REPAIR				0.5		2	N
		REPLACE				0.5		2	N
		TEST				0.5		3	N
040201	2A2A1 FILTER PWB ASSY	TEST					1.0	3	L,O
		REPAIR					1.0	2	L,O
		REPLACE				1.0		2	
040202	2A2A2 INTER-CONNECTION PWB ASSY	TEST					1.0	3	L,O
		REPAIR					1.0	2	L,O
		REPLACE				1.0		2	
040203	2A2W1 CHASSIS HARNESS ASSY	TEST					1.0	3	L,O
		REPAIR					1.0	2	L,O
		REPLACE					1.0	2	
0403	2A3 DISCRIMINA-TOR ASSY	TEST					1.0	3	L,O
		REPAIR					1.0	2	L,O
		REPLACE				1.0		2	
		ADJUST					1.0	3,10,15,18, 19,27	L,O
040301	2A3A1 DETECTOR PWB ASSY	TEST					1.0	3	L,O
		REPAIR					1.0	2	L,O
		REPLACE					1.0	2	L,O
040302	2A3A2 DIS-CRIMINATOR PWB ASSY	TEST				1.0		3	L,O
		REPAIR				1.0		2	L,O
		REPLACE				1.0		2	L,O
0404	2A4 CAPACITIVE RF TUNER ASSY	TEST					1.0	3	L,O
		REPAIR					1.0	2	L,O
		REPLACE				1.0		2	
		ADJUST					1.0	NONE	L,O
040401	2A4A1 CAPACITIVE GEAR DRIVE ASSY	TEST					1.0	3	L,O
		REPAIR					1.0	2	L,O
		REPLACE					1.0	2	
		ADJUST					1.0	NONE	L,O

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND TEST EQUIP.	(6) REMARKS
0405	2A5 INDUCTIVE RF TUNER ASSY	TEST					1.0	3	L,O
		ADJUST					1.0	NONE	L,O
		REPAIR					1.0	2	L,O
		REPLACE				0.5		2	
040501	2A4A1 COIL GEAR DRIVE ASSY	TEST					1.0	3	L,O
		ADJUST					1.0	NONE	L,O
		REPAIR					1.0	2	L,O
		REPLACE					1.0	2	
040502	2A5A2 COIL ASSY	TEST					1.0	3	L,O
		ADJUST					1.0	NONE	L,O
		REPAIR					1.0	2	L,O
		REPLACE					1.0	2	
0406	2A6 POWER SUPPLY PWB ASSY	TEST					1.0	3	L,O
		ADJUST					1.0	3,19	L,O
		REPAIR					1.0	2	L,O
		REPLACE				0.5		2	
0407	2A7 SERVO PWB ASSY	TEST					1.0	3	L,O
		REPAIR					1.0	2	L,O
		REPLACE				1.0		2	
0408	2A8 LOGIC PWB ASSY	TEST					1.0	3	L,O
		REPAIR					1.0	2	L,O
		REPLACE				2.0		2	
0409	2A9 STATIC INVERTER PWR ASSY	TEST					1.0	3	L,O
		ADJUST					1.0	14,18,19	L,O
		REPAIR					1.0	2	L,O
		REPLACE				0.5		2	
040901	2A9A1 INVERTER MODULE PWB ASSY	TEST					1.0	3,14	L,O
		REPLACE					0.2	2	L,O
		REPAIR					1.0	2	L,O
		ADJUST					1.0	2,3,14,18, 19	L,O
05	AS-2259 ANTENNA	REPAIR		0.2				1	P
06	AN/GRA-50 ANT GROUP	REPAIR		0.2				1	Q

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND TEST EQUIP.	(6) REMARKS
			C	O	F	H	D		
07	AN/GRA-39C	REPAIR		0.2				1	R
08	KIT, ANTENNA SITING	REPLACE REPAIR		0.5	 1.0			1 2	S

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR RADIO SET AN/GRC-193A

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER
1	O	TOOL KIT, ELECTRONIC EQUIPMENT, TK-101/G	5180-00-064-5178
2	F,H,D	TOOL KIT, ELECTRONIC EQUIPMENT, TK-105/G	5180-00-610-8177
3	O,F,H,D	MULTIMETER, DIGITAL AN/PSM-45	6625-01-139-2512
4	D	RF VOLTMETER AN/USM-486	6625-01-145-2430
5	H,D	50 OHM LOAD, BIRD 8325	5340-00-807-1987
6	D	AMMETER DC ME-511/U	6625-00-781-5769
7	D	T-PROBE HP-11042A	5895-00-713-4356
8	D	GENERATOR, SIGNAL SG-1171U/U (2ea)	6625-01-133-6160
9	D	ATTENUATOR CN-796/U	5985-00-087-2547
10	D	SIGNAL GEN. SG-1112(V) I/U	6625-00-566-3067
11	D	SPECTRUM ANALYZER IP-1216(P)/GR	6625-00-424-4370
12	D	PL-1388/U HP-8552B	6625-00-431-9339
13	D	PL-1399/U HP-8553B	6625-00-432-5055
14	H,D	OSCILLOSCOPE OS-261C(V)I/U	6625-01-119-7314
15	H,D	TEST SET, RF PWR, AN/URM-120A (2ea)	6625-01-039-1488
16	H,D	MAINT KIT, GROUP ELEC EQUIP OA-9163/GRC-193A	5820-01-158-7643
17	D	POWER SUPPLY PP-2309C/U	6130-01-139-2514
18	H,D	POWER SUPPLY PP-4763A/GRC	5820-00-113-9768
19	D	DEPOT FIXTURES AND ACCESSORIES - MARINE CORP DEPOT	

Section IV. REMARKS FOR RADIO SET AN/GRC-193A

REFERENCE CODE	REMARKS
A	CHECK THAT ALL CABLE CONNECTORS ARE TIGHT AND PROPERLY CONNECTED AND ENSURE THAT THE INLET AND EXHAUST OPENINGS ARE UNOBSTRUCTED.
B	LOOP DRIVE CURRENT ADJUSTMENT FOR TELETYPEWRITER OPERATION.
C	PERFORM SYSTEM OPERATIONAL, SEE PARAGRAPH 5-3.
D	REPAIR BY REPLACEMENT OF MAJOR COMPONENTS AND CABLES.
E	USE INSTALLATION KIT MK-2458/GRC-193A OR MK-2459/GRC-193A, OR MK-2460/GRC-193A, OR MK-2461/GRC-193A, OR MK-2462/GRC-193A AS PER REQUIRED APPLICATION.
F	SEE SERVICE MAINTENANCE ROUTINE SCHEDULE.
G	SEE T.M. 11-5820-919-12 FOR MAINTENANCE ALLOCATION.
H	SEE T.M. 11-5820-922-12 FOR MAINTENANCE ALLOCATION.
I	SEE T.M. 11-5820-921-34/1 FOR MAINTENANCE PROCEDURES.
J	REPAIR BY REPLACING MODULES, PWBS, AND TUBES.
K	SEE T.M. 11-5820-921-50/3 FOR MAINTENANCE PROCEDURES.
L	MARINE CORP DEPOT LEVEL TOOLS AND TEST EQUIPMENT AS REQUIRED.
M	REPAIR BY REPLACEMENT OF TRANSFORMERS, CAPACITORS, ETC.
N	SEE T.M. 11-5895-373-34/1 FOR MAINTENANCE PROCEDURES.
O	SEE T.M. 11-5895-373-50/3 FOR MAINTENANCE PROCEDURES.
P	SEE T.M. 07508A-14 FOR MAINTENANCE ALLOCATION.
Q	SEE T.M. 11-5820-467-15 FOR MAINTENANCE ALLOCATION.
R	SEE T.M. 11-5820-477-12 FOR MAINTENANCE ALLOCATION.
S	SEE T.M. 11-5820-924-12 FOR MAINTENANCE ALLOCATION.

APPENDIX C

COMPONENTS OF END ITEM LIST AND BASIC ISSUE ITEMS LISTS

Section I. INTRODUCTION

C-1. SCOPE.

This appendix lists components of end item and basic issue items for Radio Set AN/GRC-193A to help you inventory items required for safe and efficient operation.

C-2. GENERAL.

The Components of End Item and Basic Issue Items List are divided into the following sections:

a. Section II. Components of the End Item. These items when assembled, comprise the AN/GRC-193A Radio Set and must accompany it whenever it is transferred or turned in. The illustrations will help you identify these items.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the AN/GRC-193A Radio Set in operation, to operate it, and to perform emergency repairs. Although shipped seperately when packed, they must accompany the Radio Set during operation and whenever it is transferred between accountable officers. The illustrations will assist you with hard-to-identify items. This manual is your authority to requisition replacement BII, based on TOE/MTOE authorization of the end item.

C-3. EXPLANATION OF COLUMNS.

a. Illustration. This column is divided as follows:

1. Figure number. Indicates the figure number of the illustration on which the item is shown.
2. Item number. The number used to identify item called out in the illustration.

b. National Stock Number. Indicates the National stock number assigned to the item and which will be used for requisitioning.

c. Part Number. Indicates the primary number used by the manufacturer, which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and the inspection requirements to identify an item or range of items. Following the part number, the Federal Supply Code for Manufacturers (FSCM) is shown in parentheses.

d. Description. Indicates the Federal item name and, if required, a minimum description to identify the item.

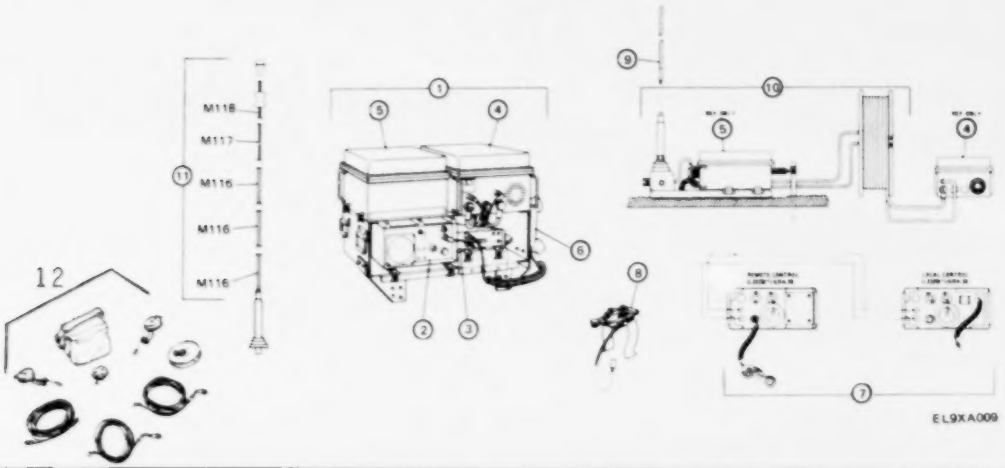
e. Location. The physical location of each item listed is given in this column. The lists are designed to inventory all items in one area of the major item before moving to an adjacent area.

f. Usable on Code. Not applicable.

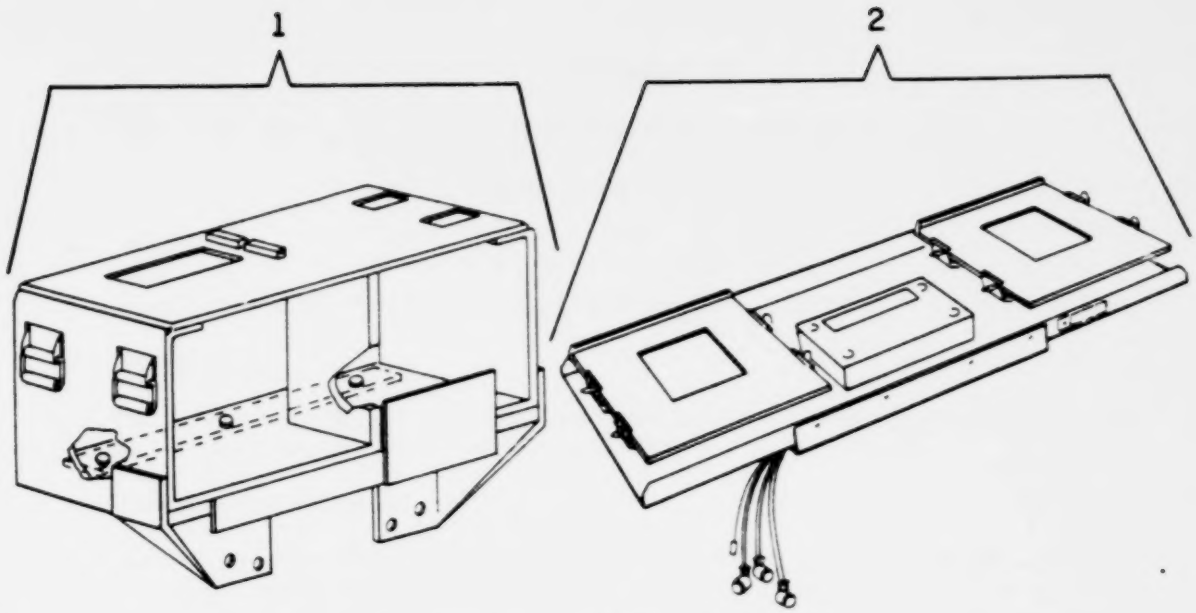
g. Quantity Required (Qty Reqd). This column lists the quantity of each item required for a complete major item.

h. Quantity. This column is left blank for use during an inventory. Under the Rcvd column, list the quantity you actually receive on your major item. The Date columns are for your use when you inventory the major item at a later date; such as for shipment to another site.

Section II. COMPONENTS OF END ITEM



(1) Illus Number	(2) National Stock Number	(3) Description FSCM and Part Number Usable On Code	(4) U/M	(5) Qty rqr
1	5820-01-133-4195	SET, RADIO AN/GRC-193A (80372) 75501780900	EA	1
2	5820-01-070-1950	AMPL-CONVERTER AM-6879/URC (80372) 755002A1800	EA	1
3	5820-01-069-2368	RCVR-XCVR RT-1209/URC (80372) 7550002A0150	EA	1
4	5965-00-069-8886	APPL, PWR AM-6545A/GRC-193A (80372) 75500283000	EA	1
5	5985-01-050-4869	CPLR, ANT CU-2064/GRC-193A (80372) 755002A8000	EA	1
6	5965-01-122-2280	HANDSET H-250/U (80063)	EA	1
7		GROUP, CONTROL AN/39C (80063)	EA	1
8	5805-00-067-5388	CW KEY KY-872 (80372) 755002A1000	EA	1
9	5985-00-106-6130	NVIS ANTENNA AS-2259 (80063) AS2259GR	EA	1
10		KIT, ANT TACTICAL SITING (80372) 75501780771	EA	1
11		AB-652, MS-116, (3 ea) MS-117, MS-118, TIP ANT, and GUARD ASSY	EA	1
12	5985-00-892-0758	GROUP, ANTENNA AN/GRA-50 (80063) PPL 1898	EA	1



SECTION III BASIC ISSUE ITEMS

(1) ILLUS NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) AND PART NUMBER	USABLE ON CODE	(4) U M	(5) QTY REQD
		Technical Manual, TM 11-5820-924-13		EA	1
1	5820-01-189-9796	Installation Kit MK-2458/GRC-193A (M561 Vehicle)		EA	1
1	5820-01-189-9797	Installation Kit MK-2459/GRC-193A (General Purpose)		EA	1
2	5820-01-189-9798	Installation Kit MK-2460/GRC-193A (M113 or M577 Vehicle)		EA	1
1	5820-01-189-9795	Installation Kit MK-2461/GRC-193A (M151 Vehicle)		EA	1
1	5820-01-189-9794	Installation Kit MK-2462/GRC-193A (M1008A1 or M882 Vehicle)		EA	1

APPENDIX D

ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

D-1. SCOPE.

This appendix lists additional items you are authorized for the support of Radio Set AN/GRC-193A.

D-2. GENERAL.

This list identifies items that do not have to accompany the AN/GRC-193A and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

D-3. EXPLANATION OF LISTING.

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i.e., CTA, MTOE, TDA, or JTA) which authorizes the item(s) to you.

Section II. ADDITIONAL AUTHORIZATION LIST

(1) National Stock Number	(2) Description Part Number & FSCM Usable on Code	(3) Unit of Meas	(4) Qty Auth
5133-00-227-5339	Countersink, 100 Degrees, 7/8-Inch Dia	Ea	1
5133-00-227-9662	Drill Bit, 5/16-Inch	Ea	1
5133-00-227-9666	Drill Bit, 3/8-Inch	Ea	1
5133-00-227-9670	Drill Bit, 7/16-Inch	Ea	1
5120-00-061-8542	Hammer, Machinist, Ball-Peen	Ea	1
6230-00-239-3518	Light, Drop SC-C539496 80063	Ea	1
	Punch, Center, 1/2x6-Inch	Ea	1
5210-00-727-1688	Tape, Measuring, Steel, 25 FT	Ea	1
5180-00-610-8177	Tool Kit, Electronic Equipment TK-105/G	Ea	1
	1/2-Inch Electric Drill	Ea	1
	Wrench, Torque, Beam-Type, 1/2-Inch Sq	Ea	1
	Drive, 0-150 FT-LBS	Ea	1
7290-00-977-9957	Heater Gun, Electric # HG 301U	Ea	1
Bchanan #33366	Crimp Tool	Ea	1
MS 24256A20	Insertion Tool	Ea	1
MS 24256R16	Extraction Tool	Ea	1

APPENDIX E

EXPENDABLE SUPPLIES AND MATERIALS LIST

E-1. SCOPE.

This appendix lists expendable supplies and materials you will need to operate and maintain Radio Set AN/GRC-193A. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

E-2. EXPLANATION OF COLUMNS.

a. Column 1-Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 3, App. E").

b. Column 2-Level. This column identifies the lowest level of maintenance that requires the listed item.

C-Operator/Crew
O-Organizational Maintenance
F-Direct Support Maintenance
H-General Support Maintenance

c. Column 3-National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column 4-Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

e. Column 5-Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) Item No.	(2) Level	(3) National Stock Number	(4) Description Part No. and FSCM	(5) Unit of Meas
1	O	5340-00-906-3666	Brush, Soft Bristled, 153350 01099	Ea
2	O	8305-00-205-3496	Cloth, Cotton Cheesecloth, CCCC 440, 81348	Ea
3	O	6850-00-984-5853	Compound, Cleaning, (Trichlorotrifluoroethane), Freon PCA, 18845	Ea
4	D	SN60WRMAP4	Solder, Tin-Lead Alloy	Ea
5	D	755017A8360	Sealant	Ea

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Vehicle Installations 2-19

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

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Commander
Stateside Army Depot
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Stateside, N.J. 07703-5007

DATE SENT
10 July 1975

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-5840-340-12	23 Jan 74	Radar Set AN/PRC-76

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PAGE NO	PARAGRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°. REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
		F03		Zone C 3. On J1-2, change "+24 VDC to "+5 VDC." REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.

SAMPLE

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SSG I. M. DeSpiritof 999-1776	SSG I. M. DeSpiritof

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TM 11-5820-924-13	14 Feb 1986	Radio Set AN/GRC-193A

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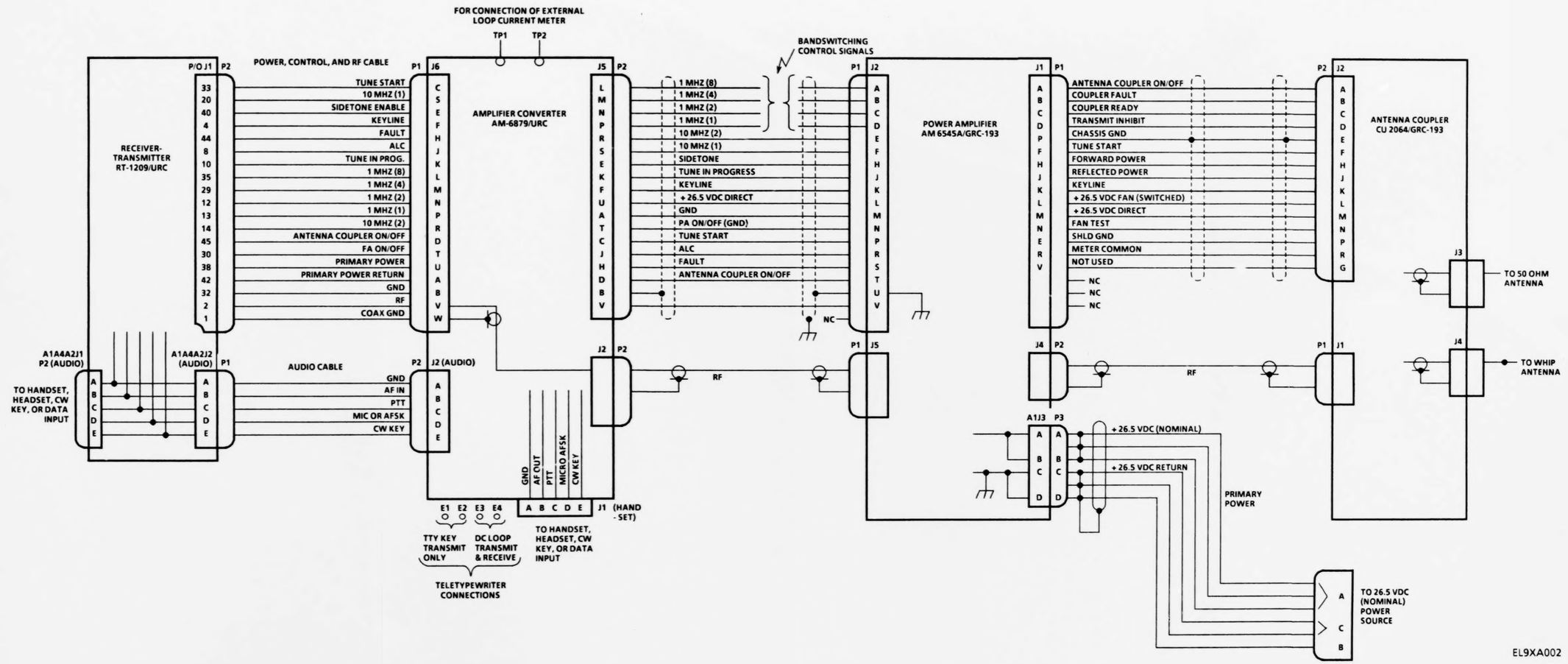

Figure FO-1. Interconnection Cabling and Wiring Diagram (AN/GRC-193A)

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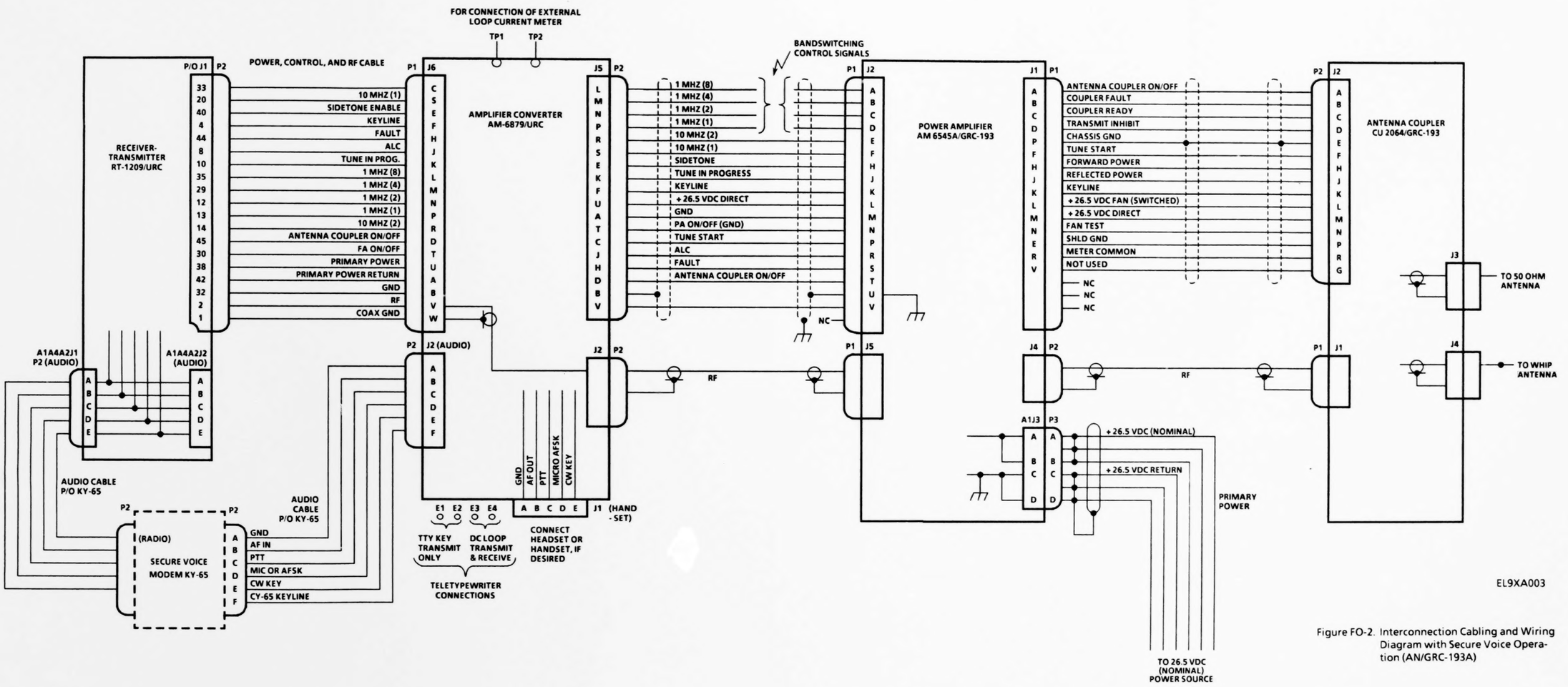

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Figure FO-2. Interconnection Cabling and Wiring Diagram with Secure Voice Operation (AN/GRC-193A)

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